

## PATENT ABSTRACTS OF JAPAN

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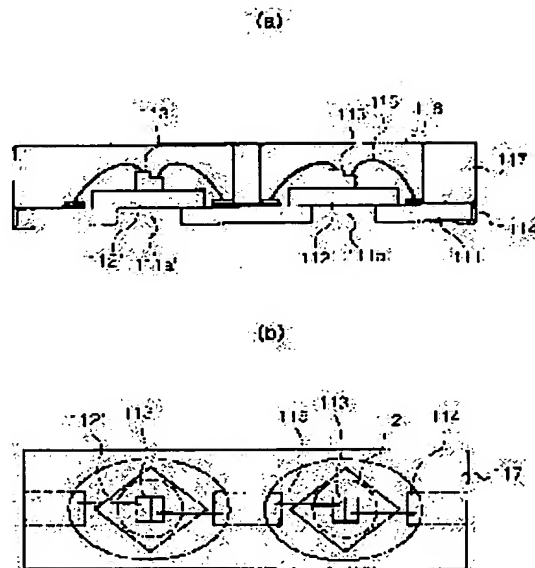
## (54) LIGHT-EMITTING DIODE, LIGHT-EMITTING DEVICE USING THE SAME, AND MANUFACTURING METHOD THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a light-emitting diode(LED), a light-emitting device which uses it, and its manufacturing method.

SOLUTION: This light-emitting device is manufactured with various heat radiation designs. On a ceramic substrate 111, where many heat radiation holes (holes for heat sink) 11 are bored, a pattern electrode of a specific style is provided first. Auxiliary ceramic sheets 112 and 112' are laminated on the ceramic substrate, to cover the respective heat radiation holes and an upper ceramic sheet 117 is laminated so that the part of the pattern electrode and the whole or part of the auxiliary ceramic sheet are exposed. On the auxiliary ceramic sheet, LED elements 113 and 113' are mounted.

Respective electrodes 114 and the LED elements are electrically connected with wires 116, and the LED elements in the upper ceramic sheet are sealed with insulation resin. The light-emitting device thus manufactured is very suitable for a large-area display and for next-generation lighting facilities, since its heat radiation characteristics are improved and the LED elements can be mounted on a large-area substrate with high density.



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CLAIMS

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[Claim(s)]

[Claim 1] The ceramic substrate which prepares one heat dissipation hole (a hole for heat sink), Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The electrode which forms a fixed pattern centering on said heat dissipation hole on said auxiliary ceramic sheet, The LED component which is electrically connected by said electrode and wire and is mounted on said auxiliary ceramic sheet, Light emitting diode characterized by having the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.

[Claim 2] Light emitting diode according to claim 1 characterized by applying a metal paste along with the contact part of said auxiliary ceramic sheet and ceramic substrate inside said heat dissipation hole.

[Claim 3] Light emitting diode according to claim 1 characterized by filling up with a metal paste inside said heat dissipation hole.

[Claim 4] Light emitting diode according to claim 3 characterized by the lower part of the metal paste with which it fills up inside said heat dissipation hole adhering to a metal plate along with said ceramic substrate.

[Claim 5] Light emitting diode according to claim 3 characterized by filling up with a metal paste inside said heat dissipation hole, and applying a metal paste to the lower part of said ceramic substrate.

[Claim 6] Light emitting diode according to claim 1 characterized by inserting a regulus (lump or slug) inside said heat dissipation hole.

[Claim 7] Said ceramic substrate and an auxiliary ceramic sheet, the ceramic substrate concerned, or an auxiliary ceramic sheet is light emitting diode according to claim 1 characterized by being an alumina or SiC.

[Claim 8] Said electrode is light emitting diode according to claim 1 characterized by consisting of a ceramic substrate side in Ag, nickel, and Au layer.

[Claim 9] Said insulating layer is light emitting diode according to claim 1 characterized by being epoxy or Si system transparency resin.

[Claim 10] Said auxiliary ceramic sheet is light emitting diode according to claim 1 characterized by establishing one heat dissipation hole in the lower part of an LED component further.

[Claim 11] A phase equipped with the ceramic substrate which prepares one heat dissipation hole, and the phase which carries out the laminating of the auxiliary ceramic sheet on said ceramic substrate, The phase of preparing the pattern electrode of a fixed gestalt centering on said heat dissipation hole on said auxiliary ceramic sheet at both sides, The phase which carries out the laminating of the up ceramic sheet which prepares opening (opening) of a predetermined configuration so that said some of pattern electrodes may be exposed on said ceramic substrate, The phase which carries out coincidence baking (co-fire) of said ceramic substrate by which a laminating is carried out, The phase of mounting an LED component on an auxiliary ceramic sheet in the location which counters with a heat dissipation hole after preparing an electrode on the pattern electrode of said auxiliary ceramic substrate, The manufacture approach of the light emitting diode characterized by having the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically respectively.

[Claim 12] Said ceramic substrate and an auxiliary ceramic sheet, the ceramic substrate concerned, or an auxiliary ceramic sheet is the manufacture approach of the light emitting diode according to claim 11 characterized by using an alumina or SiC.

[Claim 13] Said electrode is the manufacture approach of the light emitting diode according to claim 11 characterized by galvanizing nickel and Au layer in Ag paste layer on a ceramic substrate, and growing into it.

[Claim 14] Said insulating resin is the manufacture approach of the light emitting diode according to claim 11 characterized by being filled up using epoxy or Si system transparency resin.

[Claim 15] Said ceramic substrate by which a laminating is carried out is the manufacture approach of the light emitting diode according to claim 11 characterized by carrying out coincidence baking at 800-1050 degrees C.

[Claim 16] The manufacture approach of the light emitting diode according to claim 11 characterized by applying a metal paste along with the contact part of said auxiliary ceramic sheet and ceramic substrate inside said heat dissipation hole.

[Claim 17] The manufacture approach of the light emitting diode according to claim 11 characterized by being filled up with a metal paste inside said heat dissipation hole.

[Claim 18] The manufacture approach of the light emitting diode according to claim 17 characterized by being filled up with a metal paste inside said heat dissipation hole, and adhering a metal plate to the lower part of said ceramic substrate.

[Claim 19] The manufacture approach of the light emitting diode according to claim 17 characterized by being filled up with a metal paste inside said heat dissipation hole, and applying a metal paste to the lower part of said ceramic substrate.

[Claim 20] The manufacture approach of the light emitting diode according to claim 11 characterized by inserting a regulus (lump or slug) inside said heat dissipation hole.

[Claim 21] The manufacture approach of the light emitting diode according to claim 11 characterized by being smaller [ said auxiliary ceramic sheet / than said heat dissipation hole ] smaller than an LED component, and also preparing a heat dissipation hole further.

[Claim 22] The ceramic substrate which prepares one heat dissipation hole and prepares the electrode of a fixed gestalt in the both sides of the hole concerned, Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The LED component which is electrically connected by said electrode and wire and is mounted on said auxiliary ceramic sheet, Light emitting diode characterized by having the up ceramic sheet prepared on a ceramic substrate while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.

[Claim 23] Said auxiliary ceramic sheet is light emitting diode according to claim 22 characterized by establishing one heat dissipation hole in the lower part of an LED component further.

[Claim 24] The phase which is equipped with the ceramic sheet which prepares one heat dissipation hole, prepares the pattern electrode of a fixed gestalt on the ceramic sheet concerned, and manufactures a ceramic substrate, The phase which carries out the laminating of the auxiliary ceramic sheet of a fixed gestalt for said heat dissipation hole on the method of wrap aforementioned ceramic substrate, The phase which carries out the laminating of the up ceramic sheet which prepares opening of a predetermined configuration so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet may be exposed on said ceramic substrate, The phase which carries out coincidence baking of said ceramic substrate, and the phase of mounting an LED component on said auxiliary ceramic sheet after preparing an electrode on the pattern electrode of said ceramic substrate, The manufacture approach of the light emitting diode characterized by having the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically.

[Claim 25] Said heat dissipation hole so that it may be located on the ceramic substrate which prepares one heat dissipation hole, and said ceramic substrate and an LED component can be mounted A wrap auxiliary ceramic sheet, The electrode of the fixed gestalt prepared in both sides centering on a heat dissipation hole on said auxiliary ceramic sheet, The other electrodes of the fixed pattern which counters with said heat dissipation hole, is located between an auxiliary ceramic sheet and LED, and is prepared on an auxiliary ceramic sheet, The LED

component which is mounted on the other electrodes on said auxiliary ceramic sheet, and is electrically connected with the electrode of an auxiliary ceramic substrate by the wire, Light emitting diode characterized by having the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.

[Claim 26] The ceramic substrate which prepares many heat dissipation holes (holes for heat sink), Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The electrode of the fixed pattern prepared centering on said heat dissipation hole on said auxiliary ceramic sheet, The LED component which is electrically connected by said electrode and wire and is mounted on said auxiliary ceramic sheet, Luminescence equipment using the light emitting diode characterized by having the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.

[Claim 27] Said auxiliary ceramic sheet is luminescence equipment according to claim 26 characterized by establishing one heat dissipation hole in the lower part of each LED component further.

[Claim 28] A phase equipped with the ceramic substrate which prepares many heat dissipation holes, and the phase which carries out the laminating of the auxiliary ceramic sheet on said ceramic substrate, The phase of preparing the pattern electrode of a fixed gestalt in both sides centering on said heat dissipation hole on said auxiliary ceramic sheet, The phase which carries out the laminating of the up ceramic sheet which prepares opening of a predetermined configuration so that said some of pattern electrodes may be exposed on an auxiliary ceramic sheet, The phase of mounting an LED component on an auxiliary ceramic sheet in the phase which carries out coincidence baking of said ceramic substrate by which a laminating is carried out, and the location which counters with a heat dissipation hole after preparing an electrode on the pattern electrode of said auxiliary ceramic sheet, The manufacture approach of the luminescence equipment characterized by having the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically respectively.

[Claim 29] The manufacture approach of the luminescence equipment according to claim 28 characterized by being smaller [ said auxiliary ceramic sheet / than said heat dissipation hole ] smaller than an LED component, and also preparing a heat dissipation hole further.

[Claim 30] The ceramic substrate which prepares many heat dissipation holes and prepares the electrode of a fixed gestalt in the both sides of each hole, Said each hole of heat dissipation so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, Many LED components which are electrically connected by said each electrode and wire and are respectively mounted on said auxiliary ceramic sheet, Luminescence equipment using the light emitting diode characterized by having the up ceramic sheet prepared on a ceramic substrate while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.

[Claim 31] Said auxiliary ceramic sheet is luminescence equipment using the light emitting diode according to claim 30 characterized by being the auxiliary ceramic sheet which was located on the ceramic substrate and achieved method independence of a wrap of the one heat dissipation hole respectively.

[Claim 32] Said auxiliary ceramic sheet is luminescence equipment using the light emitting diode according to claim 30 characterized by being the auxiliary ceramic sheet which was located on the ceramic substrate and achieved method independence of a wrap of at least one or more heat dissipation holes respectively.

[Claim 33] The phase which is equipped with the ceramic sheet which prepares many heat dissipation holes, prepares the pattern electrode of a fixed gestalt on the ceramic sheet concerned, and manufactures a ceramic substrate, The phase which carries out the laminating of the auxiliary ceramic sheet of a fixed gestalt for said each hole of heat dissipation on the method of wrap aforementioned ceramic substrate, The phase which carries out the laminating of the up ceramic sheet which prepares opening of a predetermined configuration so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet may be exposed on a ceramic substrate, The phase which carries out coincidence baking of said ceramic substrate, and the

phase of mounting an LED component respectively on said auxiliary ceramic sheet after preparing an electrode on the pattern electrode of said ceramic substrate, The manufacture approach of the luminescence equipment using the light emitting diode characterized by having the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically respectively.

[Claim 34] The manufacture approach of the luminescence equipment using the light emitting diode according to claim 33 characterized by carrying out the laminating of the auxiliary ceramic sheet which achieved method independence of a wrap of the one heat dissipation hole respectively on said ceramic substrate.

[Claim 35] The manufacture approach of the luminescence equipment using the light emitting diode according to claim 33 characterized by carrying out the laminating of the auxiliary ceramic sheet which achieved method independence of a wrap of at least one or more heat dissipation holes on said ceramic substrate.

[Claim 36] For a heat dissipation hole, said ceramic substrate is the manufacture approach of the luminescence equipment using the light emitting diode according to claim 33 characterized by preparing further special heat dissipation opening (openings for heat sink).

[Claim 37] The manufacture approach of the luminescence equipment using the light emitting diode according to claim 33 characterized by establishing one heat dissipation hole in said auxiliary ceramic sheet further at the lower part of each LED component.

[Claim 38] Said heat dissipation hole so that it may be located on the ceramic substrate which prepares many heat dissipation holes, and said ceramic substrate and an LED component can be mounted A wrap auxiliary ceramic sheet, The electrode of the fixed gestalt prepared in both sides centering on a heat dissipation hole on said auxiliary ceramic sheet, The other electrodes of the fixed pattern which counters with said heat dissipation hole, is located between said auxiliary ceramic sheets and LED, and is prepared on an auxiliary ceramic sheet, The LED component which is mounted on the other electrodes on said auxiliary ceramic sheet, and is electrically connected with the electrode of an auxiliary ceramic substrate by the wire, Luminescence equipment using the light emitting diode characterized by having the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet while surrounding said LED component, and the insulating layer which seals the LED component in said up ceramic sheet.

[Claim 39] The luminescence unit assembly of the large area characterized by having much luminescence equipments using light emitting diode according to claim 26.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the luminescence equipment using the high density real wearing light emitting diode and this which are excellent in a heat dissipation property in detail as a thing about light emitting diode, the luminescence equipment which used this, and its manufacture approach, and suitable for the display and lighting facilities of a large area, and its manufacture approach.

[0002]

[Description of the Prior Art] Light emitting diode (henceforth LED) is a kind of a solid-state luminescence display device (indicator). The red (R) whose LED is the three primary colors of light, and the green white light (W) LED applicable to more various fields from the monochrome LED containing (G) and blue (B) were embodied. It developed into LED of a chip (SMD) gestalt with easy mounting from LED of ramp type voice at the substrate, and high density LED mounting of a large area was attained recently. In connection with this, the activity range is expanding the applicable field of LED from a common indicating equipment gradually as well as the source for back lights of a display of luminescence to the next-generation lighting facilities which can substitute for an incandescent lamp, a fluorescent lamp, and a streetlight. In the case of LED lighting facilities, unlike a common fluorescent lamp, a lighting circuit is simple, and an inverter circuit and an iron core stabilizer are unnecessary. Furthermore, the lighting facilities using LED have the advantage in which maintenance and a repair cost can be excluded as compared with a fluorescent lamp since [ with little power consumption ] a life is long 10 or more times.

[0003] As an example of representation of the white LED applied to said lighting facilities, the light emitting device which consists of LED and a fluorescent substance (phosphor) is indicated by JP,2000-315826,A. The light emitting device by said JP,2000-315826,A changes including the electrode 304 electrically connected by 2nd transparency coating section 306a which is arranged on blue LED303 mounted in the ceramic substrate 301, the 1st transparency coating section 306 which has covered the blue LED chip 303, said LED chip, and the 1st transparency coating section, and contains a fluorescent material, and said LED chip and wire 305, as shown in drawing 15 (a) and (b). Such luminescence equipment irradiates the white light which is a mixed light of the light emitted from an LED chip, and the light emitted from the fluorescent material emit the light which absorbs this light and is different. Said luminescence equipment is excellent in luminous efficiency, and can guide the color mixture light of uniform white. In addition, much LED which can embody the white light is proposed (U.S. Pat. No. 5,998,925, No. 6,069,440).

[0004]

[Problem(s) to be Solved by the Invention] By the way, it is the thermal stress (thermal stress) which is mentioned to the greatest cause concerning property degradation and failure of the application product using such LED. An LED chip emits more heat and said many proposed LED chips present the inclination for heat release to increase in proportion to the total luminescence area, when carrying out high density assembly of the natural common LED chip and using it on a direct same substrate like drawing 15 (b) at a signalling lamp, lighting facilities, etc. Especially, in the case of blue LED, since it has high driver voltage relatively as compared with the high brightness LED of other colors, the phenomenon which temperature increases is shown. It is thought that property degradation of LED and generating of failure are more excessive so that

an LED chip is moreover mounted in high density so that the area of lighting facilities is large. Moreover, existing luminescence equipment has the structure like drawing 15 (b), its heat dissipation property is not good and a limitation is in high density LED chip mounting of a large area.

[0005] This invention is made in view of such a conventional technical problem, and the purpose is offering LED which heat dissipation nature's was excellent in and was suitable for high density assembly. The purpose from which this invention differs is offering the approach of making such LED manufacture easily.

[0006] Also when carrying out high density assembly of the purpose from which this invention differs further to a large area using said LED, it is offering the luminescence equipment which was excellent in the heat dissipation property. Moreover, other purposes of this invention are offering the approach of making such luminescence equipment manufacture easily. And other purposes that this inventions differ further are offering the luminescence unit assembly (light emitting unit assembly for large area) of the large area which used such luminescence equipment.

[0007]

[Means for Solving the Problem] In order to finish said purpose, LED by this invention The ceramic substrate which prepares one heat dissipation hole (a hole for heat sink), Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The electrode which forms a fixed pattern centering on said heat dissipation hole on said auxiliary ceramic sheet, The LED component which is electrically connected by said electrode and wire and is mounted on said auxiliary ceramic sheet, Let it be a summary to have had the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet, and the insulating layer which seals the LED component in said up ceramic sheet, surrounding said LED component. Therefore, it becomes what heat dissipation nature was excellent in and was suitable for high density assembly. Let it be a summary to apply a metal paste along with the contact part of said auxiliary ceramic sheet and ceramic substrate inside said heat dissipation hole. Let it be a summary to fill up with a metal paste inside said heat dissipation hole. Let it be a summary for the lower part of the metal paste with which it fills up inside said heat dissipation hole to adhere to a metal plate along with said ceramic substrate. Let it be a summary to fill up with a metal paste inside said heat dissipation hole, and to apply a metal paste to the lower part of said ceramic substrate. Let it be a summary to insert a regulus (lump or slug) inside said heat dissipation hole. Let it be a summary for said ceramic substrate and an auxiliary ceramic sheet, the ceramic substrate concerned, or an auxiliary ceramic sheet to be an alumina or SiC. Let it be a summary for said electrode to consist of a ceramic substrate side in Ag, nickel, and Au layer. Said insulating layer makes it a summary to be epoxy or Si system transparency resin. Said auxiliary ceramic sheet makes it a summary to establish one heat dissipation hole in the lower part of an LED component further.

[0008] In order to finish said purpose, moreover, the manufacture approach of LED by this invention A phase equipped with the ceramic substrate which prepares one heat dissipation hole, and the phase which carries out the laminating of the auxiliary ceramic sheet on said ceramic substrate, The phase of preparing the pattern electrode of a fixed gestalt centering on said heat dissipation hole on said auxiliary ceramic sheet at both sides, The phase which carries out the laminating of the up ceramic sheet which prepares opening (opening) of a predetermined configuration so that said some of pattern electrodes may be exposed on said ceramic substrate, The phase which carries out coincidence baking (co-fire) of said ceramic substrate by which a laminating is carried out, The phase of mounting an LED component on an auxiliary ceramic sheet in the location which counters with a heat dissipation hole after preparing an electrode on the pattern electrode of said auxiliary ceramic substrate, Let it be a summary to have had the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically respectively. Therefore, LED which heat dissipation nature was excellent in and was suitable for high density assembly is made to manufacture easily. Said ceramic substrate and an auxiliary ceramic sheet, the ceramic substrate concerned, or an auxiliary ceramic sheet makes it a summary to use an alumina or SiC. Let it be a summary for said electrode to galvanize nickel and Au layer in Ag paste layer on a ceramic substrate, and to grow into it. Let it be a summary to be filled up with said insulating resin using

epoxy or Si system transparency resin. Let it be a summary to carry out coincidence baking of said ceramic substrate by which a laminating is carried out at 800–1050 degrees C. Let it be a summary to apply a metal paste along with the contact part of said auxiliary ceramic sheet and ceramic substrate inside said heat dissipation hole. Let it be a summary to be filled up with a metal paste inside said heat dissipation hole. Let it be a summary to be filled up with a metal paste inside said heat dissipation hole, and to adhere a metal plate to the lower part of said ceramic substrate. Let it be a summary to be filled up with a metal paste inside said heat dissipation hole, and to apply a metal paste to the lower part of said ceramic substrate. Let it be a summary to insert a regulus (lump or slug) inside said heat dissipation hole. Are smaller [ said auxiliary ceramic sheet / than said heat dissipation hole ] smaller than an LED component, and also let it be a summary to prepare a heat dissipation hole further.

[0009] In order to finish said purpose, furthermore, LED by this invention The ceramic substrate which prepared one heat dissipation hole (a hole for heat sink), and prepared the electrode of a fixed gestalt in the both sides of this hole, Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The LED component which was electrically connected by said electrode and wire and was mounted on said auxiliary ceramic sheet, It changes including the insulating layer which has sealed the LED component the up ceramic sheet prepared on the ceramic substrate, and in said up ceramic sheet, surrounding said LED component. Therefore, it becomes what heat dissipation nature was excellent in and was suitable for high density assembly. Said auxiliary ceramic sheet makes it a summary to establish one heat dissipation hole in the lower part of an LED component further.

[0010] In order to finish said purpose, moreover, the manufacture approach of LED by this invention The phase which is equipped with the ceramic sheet which prepared one heat dissipation hole (a hole for heat sink), prepares the pattern electrode of a fixed gestalt on the ceramic sheet concerned, and manufactures a ceramic substrate, The phase which carries out the laminating of the auxiliary ceramic sheet of a fixed gestalt for said heat dissipation hole on the method of wrap aforementioned ceramic substrate, The phase which carries out the laminating of the up ceramic sheet which prepared opening (opening) of a predetermined configuration so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet might be exposed on a ceramic substrate, The phase of mounting an LED component on said auxiliary ceramic sheet after preparing an electrode on the phase which carries out coincidence baking (co-fire) of said ceramic substrate, and the pattern electrode of said ceramic substrate, And after connecting an LED component to said electrode electrically, it changes including the phase which seals the LED component in said up ceramic sheet by insulating resin. Therefore, LED which heat dissipation nature was excellent in and was suitable for high density assembly is made to manufacture easily.

[0011] In order to finish said purpose, furthermore, LED by this invention Said heat dissipation hole so that it may be located on the ceramic substrate which prepares one heat dissipation hole, and said ceramic substrate and an LED component can be mounted A wrap auxiliary ceramic sheet, The electrode of the fixed gestalt prepared in both sides centering on a heat dissipation hole on said auxiliary ceramic sheet, The other electrodes of the fixed pattern which counters with said heat dissipation hole, is located between an auxiliary ceramic sheet and LED, and is prepared on an auxiliary ceramic sheet, The LED component which is mounted on the other electrodes on said auxiliary ceramic sheet, and is electrically connected with the electrode of an auxiliary ceramic substrate by the wire, Let it be a summary to have had the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet, and the insulating layer which seals the LED component in said up ceramic sheet, surrounding said LED component. Therefore, it becomes what heat dissipation nature was excellent in and was suitable for high density assembly.

[0012] In order to finish the purpose besides the above, the luminescence equipment using LED by this invention The ceramic substrate which prepares many heat dissipation holes (holes for heat sink), Said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, The electrode of the fixed pattern prepared centering on said heat dissipation hole on said auxiliary ceramic sheet, The LED component which is electrically connected by said electrode and wire and is mounted on said auxiliary ceramic sheet, Let it be a summary to have had the up ceramic

sheet by which a laminating is carried out on an auxiliary ceramic sheet, and the insulating layer which seals the LED component in said up ceramic sheet, surrounding said LED component. Therefore, also when high density assembly was carried out to a large area using said LED, the heat dissipation property should be excellent. Said auxiliary ceramic sheet makes it a summary to establish one heat dissipation hole in the lower part of each LED component further.

[0013] In order to finish the purpose besides the above, moreover, the manufacture approach of the luminescence equipment using LED by this invention A phase equipped with the ceramic substrate which prepares many heat dissipation holes, and the phase which carries out the laminating of the auxiliary ceramic sheet on said ceramic substrate, The phase of preparing the pattern electrode of a fixed gestalt in both sides centering on said heat dissipation hole on said auxiliary ceramic sheet, The phase which carries out the laminating of the up ceramic sheet which prepares opening of a predetermined configuration so that said some of pattern electrodes may be exposed on an auxiliary ceramic sheet, The phase of mounting an LED component on an auxiliary ceramic sheet in the phase which carries out coincidence baking of said ceramic substrate by which a laminating is carried out, and the location which counters with a heat dissipation hole after preparing an electrode on the pattern electrode of said auxiliary ceramic sheet, Let it be a summary to have the phase which seals the LED component in said up ceramic sheet by insulating resin after connecting an LED component to said electrode electrically respectively. Therefore, also when carrying out high density assembly to a large area using said LED, the luminescence equipment which should be excellent in the heat dissipation property is made to manufacture easily. Are smaller [ said auxiliary ceramic sheet / than said heat dissipation hole ] smaller than an LED component, and also let it be a summary to prepare a heat dissipation hole further.

[0014] In order to finish the purpose besides the above, furthermore, the luminescence equipment using LED by this invention The ceramic substrate which prepared many heat dissipation holes (holes for heat sink), and prepared the electrode of a fixed gestalt in the both sides of each hole, Said each heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted The auxiliary ceramic sheet of a wrap fixed gestalt, Many LED components which were electrically connected by said each electrode and wire and were respectively mounted on said auxiliary ceramic sheet, It changes including the insulating layer which seals the LED component the up ceramic sheet prepared on the ceramic substrate, and in said up ceramic sheet, surrounding said many LED components. Therefore, also when high density assembly was carried out to a large area using said LED, the heat dissipation property should be excellent. Let it be a summary for said auxiliary ceramic sheet to be an auxiliary ceramic sheet which was located on the ceramic substrate and achieved method independence of a wrap of the one heat dissipation hole respectively. Let it be a summary for said auxiliary ceramic sheet to be an auxiliary ceramic sheet which was located on the ceramic substrate and achieved method independence of a wrap of at least one or more heat dissipation holes respectively.

[0015] In order to finish the purpose besides the above, moreover, the manufacture approach of the luminescence equipment using LED by this invention The phase which is equipped with the ceramic sheet which prepared many heat dissipation holes, prepares the pattern electrode of a fixed gestalt on the ceramic sheet concerned, and manufactures a ceramic substrate, The phase which carries out the laminating of the auxiliary ceramic sheet of a fixed gestalt for said each heat dissipation hole on the method of wrap aforementioned ceramic substrate, The phase which carries out the laminating of the up ceramic sheet which prepared opening of a predetermined configuration so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet might be exposed on a ceramic substrate, The phase of mounting many LED components respectively on said auxiliary ceramic sheet after preparing an electrode on the phase which carries out coincidence baking of said ceramic substrate, and the pattern electrode of said ceramic substrate, After connecting an LED component to said electrode electrically respectively, it changes including the phase which seals the LED component in said up ceramic sheet by insulating resin. Therefore, also when carrying out high density assembly to a large area using said LED, the luminescence equipment which should be excellent in the heat dissipation property is made to manufacture easily. Let it be a summary to carry out the laminating of the auxiliary ceramic sheet which achieved method independence of a wrap of the one heat dissipation hole respectively on said ceramic substrate. Let it be a summary to carry out the

laminating of the auxiliary ceramic sheet which achieved method independence of a wrap of at least one or more heat dissipation holes on said ceramic substrate. Said ceramic substrate makes it a summary to prepare further heat dissipation opening (openings for heat sink) with a special heat dissipation hole. Let it be a summary to establish one heat dissipation hole in the lower part of each LED component further at said auxiliary ceramic sheet.

[0016] In order to finish said purpose, furthermore, the luminescence equipment using LED by this invention Said heat dissipation hole so that it may be located on the ceramic substrate which prepares many heat dissipation holes, and said ceramic substrate and an LED component can be mounted A wrap auxiliary ceramic sheet, The electrode of the fixed gestalt prepared in both sides centering on a heat dissipation hole on said auxiliary ceramic sheet, The other electrodes of the fixed pattern which counters with said heat dissipation hole, is located between said auxiliary ceramic sheets and LED, and is prepared on an auxiliary ceramic sheet, The LED component which is mounted on the other electrodes on said auxiliary ceramic sheet, and is electrically connected with the electrode of an auxiliary ceramic substrate by the wire, Let it be a summary to have had the up ceramic sheet by which a laminating is carried out on an auxiliary ceramic sheet, and the insulating layer which seals the LED component in said up ceramic sheet, surrounding said LED component. Therefore, also when high density assembly was carried out to a large area using said LED, the heat dissipation property should be excellent.

[0017] In order to finish the above and also other purposes, the luminescence unit assembly luminescence equipment using LED by this invention makes it a summary to have much luminescence equipments which used light emitting diode according to claim 26. Therefore, the luminescence unit assembly of a large area is realizable.

[0018]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail. This invention minimizes the thermal stress of LED and the luminescence equipment using this by various heat dissipation designs. In connection with this, this invention raises an LED property and will become very useful as a source of luminescence of next-generation lighting facilities.

[0019] (LED and its manufacture approach) Drawing 1 shows an example of LED by this invention. Drawing 1 (a) is the cross-section block diagram of LED which is the gestalt of 1 operation of this invention, and drawing 1 (b) is the top view. After LED by this invention contains the auxiliary ceramic sheet 12 by which the laminating was carried out on the ceramic substrate 11 and said ceramic substrate 11, the up ceramic sheet 16, a light emitting device 13, and an electrode 14 if it is divided roughly as shown in drawing 1 (a) and (b), it changes.

[0020] Said ceramic substrate 11 is equipped with one heat dissipation hole 11a in the gestalt of this operation. Furthermore, on the front face of a ceramic substrate 11, the pattern electrode of a fixed gestalt is prepared at the both sides of said heat dissipation hole 11a. Said heat dissipation hole is very suitable for emitting the heat which it has been arranged at the lower part of an LED component, and was generated from the LED component to the direct air, and minimizing the thermal stress of LED. Of course, there may not be need that a heat dissipation hole is not necessarily circular, and what kind of configurations, such as a rectangular head or a polygon, are sufficient as it. As long as said ceramic substrate is a substrate which can carry out high density assembly of the LED component, what kind of thing is sufficient as it. For example, an alumina (alumina), Xtal (quartz), calcium zirconate (calcium zirconate), olivine (forsterite), SiC, a graphite, a melting silica (fused silica), a mullite (mullite), cordierite (cordierite), a zirconia (zirconia), beryllia (beryllia), alumimium nitride (aluminum nitride), etc. can be mentioned as such a ceramic substrate. Therefore, although the quality of the material of a ceramic substrate is not limited specially, an alumina or the SiC quality of the material is suitable especially. It is using an alumina more preferably. An alumina ceramic has electric insulation and high thermal conductivity. Furthermore, the alumina ceramic is excellent in thermal resistance, chemical resistance, and a mechanical strength, and has the advantage in which there is little especially radiation emission. Furthermore, on it, an alumina ceramic can prepare a metallic conductor circuit pattern, and can use it as a laminating mold ceramic package (multi-layer ceramic package; MLP) according to a baking process. Airtightness is excellent when used as such a package.

[0021] Said auxiliary ceramic sheet 12 is a wrap about said heat dissipation hole so that it may be located on said ceramic substrate and an LED component can be mounted. It is most suitable to use an alumina or the SiC quality of the material like [ the auxiliary ceramic sheet 12 ] the

above. Said auxiliary ceramic sheet may be variously constituted irrespective of the gestalt and configuration. Although only shown by the rectangular head or the rhombus in drawing 1 (b), it can consist of various gestalten so that it may be shown variously henceforth. LED13 of a light emitting device is electrically connected by the electrode 14 and wire 15 which were mounted on said auxiliary ceramic sheet and prepared on the ceramic substrate, its outcrossing line pattern, etc. LED by this invention is applicable irrespective of the gestalt and class of LED component. Therefore, it cannot be overemphasized that RGB LED can be applied not only to the white light LED but to the LED component of various hues, of course. An LED component is surrounded with the up ceramic sheet 17 prepared on the ceramic substrate along the perimeter of a ceramic substrate, and is sealed by the insulating layer 16.

[0022] Said insulating layer 16 protects an LED component from external physical / chemical erosion, and it consists of the transparence quality of the material so that the light irradiated from an LED component may be passed. As the quality of the material of a desirable insulating layer, epoxy or Si system transparency resin can be mentioned.

[0023] Drawing 2 (a) and (b) show the gestalt of the operation from which LED by this invention differs. In the various kinds LED of drawing 2 (a) and (b), each agreement supports drawing 1 (a) and (b) so that it may be easy to understand. First, drawing 2 (a) shows LED in which other heat dissipation hole 22a was prepared to said auxiliary ceramic sheet 22 with which the LED component 23 was mounted. As for said other heat dissipation hole 22a, it is natural that it is smaller than the LED component 23. Furthermore, it is desirable to prepare smaller than heat dissipation hole 21a of a ceramic substrate 21. It is predicted that LED of drawing 2 (a) is excellent in a heat dissipation property as compared with LED shown in drawing 1 in order that the LED component 23 may contact direct air.

[0024] To drawing 2 (b), LED of the gestalt of further different operation of this invention is illustrated. Unlike LED shown in drawing 2 (a), it consists of the structure where the laminating of the auxiliary ceramic sheet 32 was continued and carried out to the ceramic substrate 31 whole. Furthermore, it is located in the auxiliary ceramic sheet 32 whose electrode 34 is not a ceramic substrate, either. LED which consists of such structure has a big advantage in a production process so that it may explain henceforth.

[0025] Furthermore, LED illustrated to drawing 2 (c) has prepared one heat dissipation hole 42a in the auxiliary ceramic sheet 42 further in the LED structure of drawing 2 (b). LED illustrated to drawing 2 (c) is equipped with all the advantages of LED illustrated to drawing 2 (a) and drawing 2 (b). Namely, in a production process, emission of the heat generated from LED is not only easy, but has a big advantage.

[0026] LED illustrated above corresponds, when it has the electrode which was suitable in use of the blue which used the nitride compound as an LED component, or a white light LED component. However, in the case of the LED component which consists of other semiconducting compounds, i.e., GaAs, GaP and SiC, ZnSe, etc., it is based on the electrical conductivity of the substrate itself, and an electric-field impression method is held by the LED component top and the lower part. Therefore, as for the LED component in this case, a lower electrode is prepared caudad. An example of LED suitable for such an LED component is shown in drawing 2 (d). Electrode structure differs from LED which illustrated previously LED illustrated to drawing 2 (d) greatly. Therefore, as for the LED component 53 mounted on the auxiliary ceramic sheet 52, lower other electrode 54a may be electrically connected with an electrode 54 by wire 55 grade. In this case, although heat dissipation hole 51a is prepared in the ceramic substrate 51, a heat dissipation hole can be established also in an auxiliary ceramic sheet.

[0027] Although LED explained above can stop the thermal stress of LED effectively by various heat dissipation designs, each LED may promote a heat dissipation property more effectively by the approach with which applies a conductive ingredient to a heat dissipation hole, or it is filled up. To drawing 3 R> 3, the method applied to LED of drawing 1 is illustrated. On the other hand, drawing 3 (a) shows as a formula the LED by which metal paste 18a was applied along the contact surface of the auxiliary ceramic sheet 12 and a ceramic substrate 11 inside heat dissipation hole 11a. Furthermore, drawing 3 (b) illustrates LED with which metal paste 18b was filled up inside said heat dissipation hole 11a. Furthermore, drawing 3 (c) is LED in which the lower part of LED of drawing 3 (b) with which the metal paste was filled up inside heat dissipation hole 11a adhered to the metal plate 19 along with the ceramic substrate 11. Drawing 3 (d) shows LED which 18d (lump or slug) of reguluses was inserted inside heat dissipation hole

11a, and was pasted up with a metal paste. LED shown in drawing 3 R> 3 (e) is the structure where filled up with the metal paste upwards inside heat dissipation hole 11a, and metal paste 18e was altogether applied along with the lower part of a ceramic substrate 11. All of these LED are excellent in the heat dissipation property as compared with the case where only a heat dissipation hole is prepared, in order that thermal emission may carry out more easily by heat dissipation hole 11a. It cannot be overemphasized that such structure can be identically applied not only to LED illustrated to drawing 1, of course but to LED of drawing 2 by which the heat dissipation design was carried out variously.

[0028] LED which has such various heat dissipation structures is manufactured through the process like a degree. That is, for example, the manufacture approach of LED of drawing 1 is equipped with the ceramic sheet 11 which prepared one heat dissipation hole 11a first. The heat dissipation hole of said ceramic sheet can be easily prepared by punching. Subsequently, on a ceramic sheet, the pattern electrode 14 of a fixed gestalt is formed with a screen-stencil method etc. It cannot be overemphasized that said pattern electrode can be variously changed by design. In this invention, Ag content paste is suitable as a pattern electrode. Said ceramic substrate can carry out the laminating of one piece or the two ceramic sheets or more, and can constitute them. Furthermore, other circuit patterns can be prepared in a ceramic substrate as occasion demands. After having said ceramic substrate, the laminating of the auxiliary ceramic sheet 12 of the fixed gestalt which can cover said heat dissipation hole is carried out. What is necessary is just to make the auxiliary ceramic sheet 32 into the same magnitude as a ceramic substrate 31 in the case of LED illustrated by drawing 2 (b).

[0029] Subsequently, it has the up ceramic sheet 17 with which opening (opening) of a predetermined configuration was prepared so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet may be exposed, and the laminating of this is carried out on a ceramic substrate. Then, said ceramic substrate performs coincidence baking. Under the present circumstances, it is desirable to perform coincidence baking at about 800-1050 degrees C.

[0030] Then, an electrode is prepared with plating on the pattern electrode of said ceramic substrate. As for an electrode, in this invention, it is desirable to galvanize nickel and Au one by one in Ag paste layer on a ceramic substrate. After preparing said electrode, the LED component 13 prepared on the auxiliary ceramic sheet 12 is mounted. Then, since said electrode and LED component are electrically connected with a wire 15, the LED component 13 in said up ceramic sheet 17 is sealed by insulating resin.

[0031] (Luminescence equipment and its manufacture approach) On the other hand, this invention offers the luminescence equipment with which thermal stress is sharply reduced using LED which is the fundamental unit light emitting device obtained by the aforementioned various heat dissipation designs. The luminescence equipment of this invention does not mount LED of said item in one PCB substrate, but mounts it on the metal pattern electrode which continues within the package which unified the LED component.

[0032] Drawing 4 shows an example of luminescence equipment which used LED of this invention. Drawing 4 (a) is the cross-section configuration of the luminescence equipment which is the gestalt of 1 operation of this invention, and drawing 4 (b) is the top view. the auxiliary ceramic sheet 112 by which divided roughly and the laminating was carried out on the ceramic substrate 111 and said ceramic substrate as the luminescence equipment by this invention was shown in drawing 4, 112', and the up ceramic sheet 116 and light emitting devices 113 and 113 - ' And it changes including an electrode 114. Such luminescence equipment has the \*\*\*\* structure which combined much LED of drawing 1.

[0033] Concretely, in the gestalt of this operation, said ceramic substrate 111 has prepared many heat dissipation hole 111a and 111a'. Furthermore, on the front face of a ceramic substrate 111, the pattern electrode of a fixed gestalt is prepared at the both sides of said heat dissipation hole 111a and 111a'. Said heat dissipation hole is very suitable for emitting the heat which it has been arranged at the lower part of an LED component, and was generated from the LED component to the direct air, and minimizing the thermal stress of LED as above-mentioned. Of course, what kind of configuration is sufficient as a heat dissipation hole. As long as a ceramic substrate is a substrate which can carry out high density assembly of the LED component, what kind of thing is sufficient as it. Although the quality of the material of a ceramic substrate is limited specially and does not have an end as above-mentioned, an alumina or the SiC quality of the material is suitable for it especially. It is using an alumina more preferably.

[0034] Said auxiliary ceramic sheet 112 and 112' have covered said heat dissipation hole so that it may be located on said ceramic substrate and each LED component can be mounted. It is most suitable that the auxiliary ceramic sheet 112 and 112' as well as the above use an alumina or the SiC quality of the material. Said auxiliary ceramic sheet can be variously constituted irrespective of the gestalt and configuration. Although it only consists of the rectangular head or the rhombus in drawing 1 (b), it can consist of various gestalten so that it may show variously henceforth. Furthermore, in drawing 4 (a), auxiliary ceramic sheets are the auxiliary ceramic sheet which was located on the ceramic substrate 111 and achieved wrap independence of the one heat dissipation hole 111a respectively, and an auxiliary ceramic sheet which achieved method independence of a wrap of at least one or more heat dissipation holes respectively (refer to drawing 2 (b), drawing 2 (c), drawing 11 (b), and drawing 12 R> 2 (b)).

[0035] LED113 and 113' which are a light emitting device are mounted on said auxiliary ceramic sheet, and are electrically connected by the electrode 114 and wire 115 which were prepared on the ceramic substrate, its outcrossing line pattern, etc. LED mounted in the luminescence equipment by this invention is applicable irrespective of the gestalt and class of LED component. Therefore, it cannot be overemphasized that RGB LED can be applied not only to the white light LED but to the LED component of various hues, of course. An LED component is surrounded with the up ceramic sheet 117 prepared on the ceramic substrate along the perimeter of a ceramic substrate, and is sealed by the insulating layer 116. As for said insulating layer 116, it is desirable to consist of epoxy or Si system transparency resin.

[0036] Drawing 5 shows the gestalt of the operation from which the luminescence equipment by this invention differs. In the various luminescence equipments of drawing 5, each agreement supports drawing 4 so that it may be easy to understand. First, drawing 5 (a) shows the LED component 123, said auxiliary ceramic sheet 122 with which 123' was mounted, and the luminescence equipment with which other heat dissipation hole 122a and 122a' was prepared in 122'. Such luminescence equipment has the \*\*\*\* structure which combined much LED of drawing 2 (a). It cannot be overemphasized that heat dissipation hole 122a and 122a' is smaller than the LED component 123 and 123' in the luminescence equipment by drawing 5 (a). Furthermore, it is desirable to form smaller than heat dissipation hole 121a of a ceramic substrate 121 and 121a'. It is predicted that a heat dissipation property is excellent as compared with the luminescence equipment which showed the luminescence equipment by drawing 5 (a) to drawing 4 in order that the LED component 123 and 123' might contact direct air.

[0037] To drawing 5 (b), the luminescence equipment of the gestalt of further different operation of this invention is illustrated. Unlike the luminescence equipment illustrated by drawing 4, the luminescence equipment shown in drawing 5 (b) has the structure where the laminating of the auxiliary ceramic sheet 132 is continued and carried out to the ceramic substrate 131 whole. Furthermore, an electrode 134 is also located in the auxiliary ceramic sheet 132 instead of a ceramic substrate. Such luminescence equipment has the structure which combined LED of a large number illustrated to drawing 2 (b), and as shown in future manufacture processes, it has a big advantage.

[0038] Furthermore, the luminescence equipment illustrated to drawing 6 (a) has prepared further one heat dissipation hole 142a and 142a' in the auxiliary ceramic sheet 142 in the structure of the luminescence equipment of drawing 5 R> 5 (b). Such luminescence equipment has the structure which combined LED of a large number illustrated to drawing 2 (c).

[0039] The luminescence equipment shown in drawing 6 (b) shows the case of being suitable for the structure which combined the LED component of a large number illustrated to drawing 2 (b). That is, an electric-field impression method is held by an LED component top and the lower part with the electrical conductivity of the substrate itself as what has the structure which combined the LED component of a large number which illustrated such luminescence equipment to drawing 2 (d). said luminescence equipment -- the auxiliary ceramic sheet 152 and 152' -- it is located in the LED component 153 mounted upwards and the lower part of 153', and also electrode 154a and 154' are electrically connected with an electrode 154 and 154' by a wire 155, 155', etc. In this case, although heat dissipation hole 151a is prepared in the ceramic substrate 151, a heat dissipation hole can be further prepared also on an auxiliary ceramic sheet.

[0040] Although the luminescence equipment explained above can stop the thermal stress of LED effectively by various heat dissipation designs, each luminescence equipment can increase a heat dissipation property more effectively by the approach with which applies a conductive

ingredient to a heat dissipation hole, or it is filled up. To drawing 7, the method applied to the luminescence equipment of drawing 4 is illustrated. As for drawing 7 (a), the luminescence equipment with which metal paste 118a was applied inside heat dissipation hole 111a as a formula on the other hand is shown along the contact surface of the auxiliary ceramic sheet 112 and a ceramic substrate 111. Furthermore, drawing 7 (b) has illustrated the luminescence equipment with which it filled up with metal paste 118b inside said heat dissipation hole 111a. Furthermore, drawing 7 (c) is luminescence equipment with which the lower part of LED adhered to the metal plate 119 along with the ceramic substrate 111 in the luminescence equipment of drawing 7 (b) with which it filled up with the metal paste inside heat dissipation hole 111a. Drawing 8 (a) shows the luminescence equipment which 118d (lump or slug) of reguluses was inserted inside heat dissipation hole 111a, and was pasted up with a metal paste. The luminescence equipment illustrated to drawing 8 (b) is the structure where filled up with the metal paste upwards inside heat dissipation hole 111a, and metal paste 118e was altogether applied along with the lower part of a ceramic substrate 111. All of these luminescence equipments are excellent in the heat dissipation property as compared with the case where thermal emission is more easily prepared only in a deed heat dissipation hole by heat dissipation hole 111a. It cannot be overemphasized that such structure can be identically applied not only to the luminescence equipment illustrated to drawing 4, of course but to drawing 5 and the luminescence equipment of 6 by which the heat dissipation design was carried out variously.

[0041] As for the production process of luminescence equipment which has such various heat dissipation structures, it is more various that it is fundamentally similar with the LED production process of an item. It will be as follows if the manufacture approach of this invention in the luminescence equipment illustrated by drawing 4 is explained based on drawing 9. As shown in drawing 9 (a) and drawing 9 (b), it has the ceramic sheet which prepared many heat dissipation hole 111a and 111a' according to the punching process first. On this ceramic sheet, the pattern electrode 114 of a fixed gestalt is formed with a screen-stencil method etc. like drawing 9 (c). It cannot be overemphasized that said pattern electrode 114 can be variously changed by design. In this invention, Ag content paste is suitable as a pattern electrode. A ceramic substrate can carry out the laminating of one piece or the two ceramic sheets or more, and can constitute them. Furthermore, other circuit patterns can be prepared in a ceramic substrate as occasion demands. After having said ceramic substrate, the laminating of the auxiliary ceramic sheet 112 of the fixed gestalt which can cover said heat dissipation hole, and 112' is carried out like drawing 9 (d). Although said auxiliary ceramic sheet can be prepared so that one heat dissipation hole may be respectively covered on said ceramic substrate, at least one or more heat dissipation holes can also consist of auxiliary ceramic sheets which achieved method independence of a wrap. Drawing 10 shows such an example. After carrying out the laminating of the independent auxiliary ceramic sheet 162 which can cover a series of heat dissipation holes 161a, 161b, and 161c of a ceramic substrate 161 on a ceramic substrate 161, the process which carries out the laminating of the up ceramic sheet 167 is shown [ in / both / the production process of the heat radiator shown in drawing 10 (a) thru/or drawing 10 (c) ]. Furthermore, said auxiliary ceramic sheet can also be constituted so that one heat dissipation hole may be respectively established further in the lower part of an LED component (refer to drawing 5 (a)).

[0042] Subsequently, like drawing 9 (e), it has the up ceramic sheet 117 which prepared opening of a predetermined configuration so that said some of pattern electrodes, and some or all of an auxiliary ceramic sheet may be exposed, and a laminating is carried out on said ceramic substrate. Then, said ceramic substrate performs coincidence baking. Under the present circumstances, it is desirable to perform coincidence baking at about 800-1050 degrees C. Then, an electrode is prepared with plating on the pattern electrode of said ceramic substrate like drawing 9 (f). As for an electrode, in this invention, it is desirable to galvanize nickel and Au one by one in Ag paste layer on a ceramic substrate. After preparing said electrode, the auxiliary ceramic sheet 112, the LED component 113 which it had on 112', and 113' are mounted. Then, since said electrode 114 and LED component are electrically connected with a wire, the LED component 113 in said up ceramic sheet 117 and 113' are sealed by insulating resin.

[0043] Drawing 11 shows the production process from which the luminescence equipment by this invention differs further. Probably, the luminescence equipment pass such a production process has the structure like drawing 6 (a). Unlike the production process of drawing 9, the production process shown in drawing 11 R> 1 has the advantage that one auxiliary ceramic sheet 152 may

be used, and a production process may actually be simplified sharply. A pattern electrode is not prepared on the ceramic substrate 151 which prepared heat dissipation hole 151a and 151a', but the manufacture approach of the luminescence equipment proposed to drawing 1111 is established on the auxiliary ceramic sheet 152. That is, it has the auxiliary ceramic sheet which it was smaller [ than said heat dissipation hole 151a and 151a' ] smaller than the LED component, and also prepared heat dissipation hole 152a and 152a' according to the punching process, and after carrying out a laminating so that the center line of a heat dissipation hole may be in agreement on said ceramic substrate ( drawing 11 (c)), the pattern electrode 154 of a fixed gestalt is formed on an auxiliary ceramic sheet ( drawing 11 (d)). Future production processes are the same as that of drawing 9 .

[0044] The production process of the luminescence equipment by this invention can also prepare heat dissipation opening (openings for heat sink) with the special heat dissipation hole of not only this but said ceramic substrate. Drawing 1212 shows such an example. In case a ceramic substrate 171 is manufactured to drawing 12 , heat dissipation hole 171a and 171a' shows the process which pierced the special heat dissipation means like heat dissipation opening by punching around said heat dissipation hole separately. Since the luminescence equipment which has such structure can radiate heat in the air very much in a larger area in the heat generated from the LED component, using much luminescence equipments, it is high-density, can combine a luminescence unit assembly, and has the advantage that the luminescence side of a luminescence unit assembly can be further constituted more in a large area.

[0045] In the manufacture approach of this invention, the up ceramic sheet 177 can consist of various gestalten. An up ceramic sheet can be designed in various configurations according to external environments, such as a user or a service condition. Drawing 13 R> 3 has illustrated the various configurations of an up ceramic sheet. In opening or the aperture (windows) of said up ceramic sheet shown in drawing 13 , the number of LED is arranged appropriately, and the area and the gestalt of a luminescence side can be determined efficiently.

[0046] (Luminescence unit assembly) At least one or more luminescence equipments explained in this invention until now can be arranged, and the luminescence unit assembly of a large area can be constituted. Drawing 14 omitted the up ceramic sheet in the drawing so that easily [ an understanding ] as an example of the assembly of such a luminescence unit. The luminescence unit assembly by this invention arranges the luminescence unit 210 appropriately, and changes. Furthermore, since a configuration and a gestalt are appropriately formed in the upper part for the up ceramic sheet by which a laminating is carried out by punching in a luminescence unit assembly and the configuration of luminescence area and a luminescence side can be adjusted, the amount of the light irradiated from an LED component can also be adjusted. Since emission of the heat which various heat dissipation designs can be performed and is generated from an LED component is easy for especially the luminescence unit assembly of this invention, an LED component can be designed to a high density large area.

[0047]

[Effect of the Invention] Like \*\*\*\*, LED by this invention emits efficiently the heat generated from an LED component by various heat dissipation designs, and thermal stress of an LED component is made as for it to minimization, and it can perform stable actuation of an LED component. Furthermore, this invention offers the luminescence equipment which can mount an LED component in a large area substrate by high density. Such luminescence equipment fits very much the next-generation lighting facilities which can substitute for not only sources of luminescence, such as a display which presents various hues (full color), but an incandescent lamp, a fluorescent lamp, and a streetlight.

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[Translation done.]

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the block diagram of the light emitting diode by this invention.

[Drawing 2] It is the sectional view of different light emitting diode by this invention.

[Drawing 3] It is the sectional view of further different light emitting diode by this invention.

[Drawing 4] It is the block diagram of the luminescence equipment by this invention.

[Drawing 5] It is the sectional view of different luminescence equipment by this invention.

[Drawing 6] It is the sectional view of different luminescence equipment by this invention.

[Drawing 7] It is the sectional view of further different luminescence equipment by this invention.

[Drawing 8] It is the sectional view of further different luminescence equipment by this invention.

[Drawing 9] The production process Fig. of the luminescence equipment by this invention is illustrated.

[Drawing 10] It is a part of production process from which the luminescence equipment by this invention differs.

[Drawing 11] The production process Fig. where the luminescence equipment by this invention differs further is illustrated.

[Drawing 12] It is a part of production process from which the luminescence equipment by this invention differs further.

[Drawing 13] It is the instantiation Fig. of the up ceramic sheet of the luminescence equipment by this invention.

[Drawing 14] It is the block diagram of the large area luminescence equipment using the light emitting device by this invention.

[Drawing 15] (a) is the sectional view of the conventional light emitting device, and (b) is the sectional view of the luminescence equipment which used the light emitting device of (a).

[Description of Notations]

111, 121, 131, 141, 151, 161, 171 Ceramic substrate

111a, 121a, 131a, 141a, 151a, 161a, a 171a heat dissipation hole

112, 122, 132, 142, 152, 162, 172 Auxiliary ceramic sheet

113, 123, 133, 143, 153, 163, 173 Light emitting diode

114, 124, 134, 144, 154, 164, 174 Electrode

115, 125, 135, 145, 155, 165, 175 Wire

116, 126, 136, 146, 156, 166, 176 Insulating layer

117, 127, 137, 147, 157, 167, 177 Up ceramic sheet

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[Translation done.]

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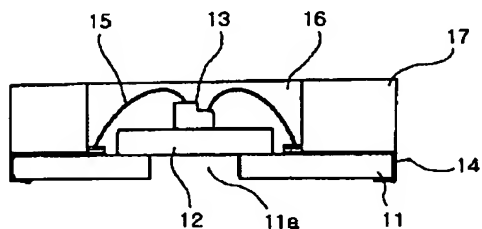
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DRAWINGS

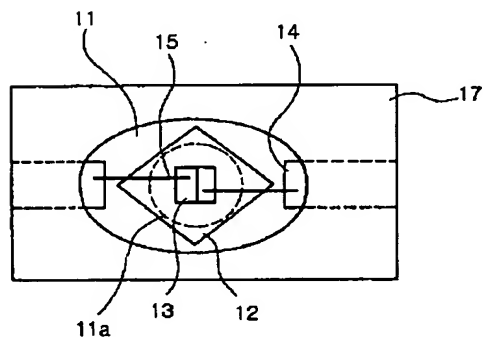
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[Drawing 1]

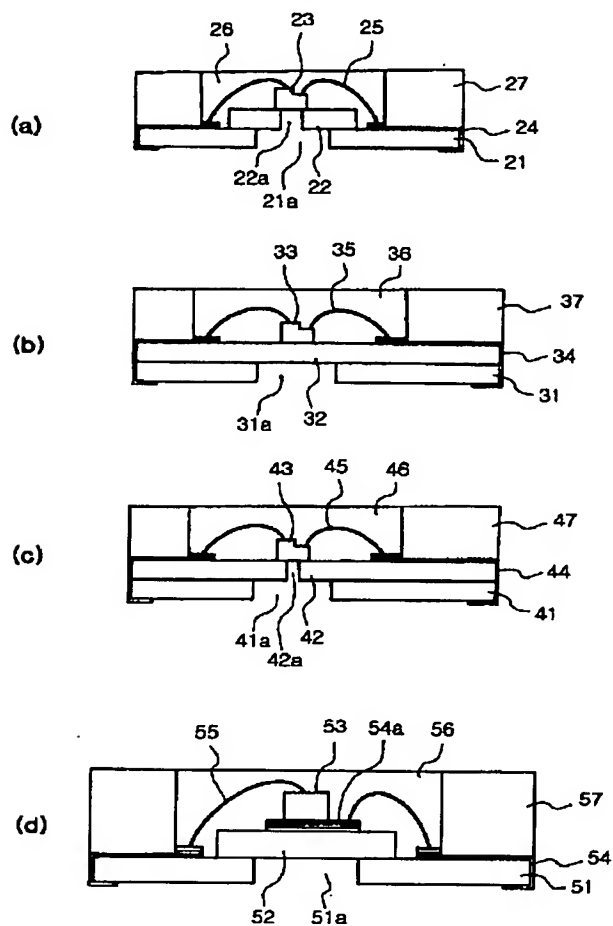
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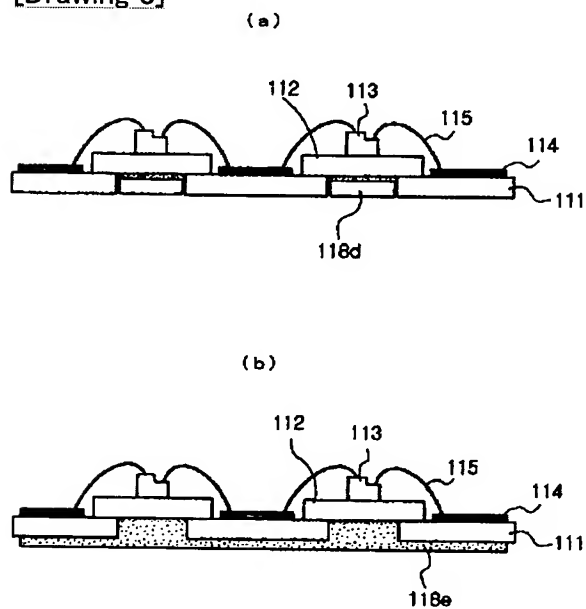
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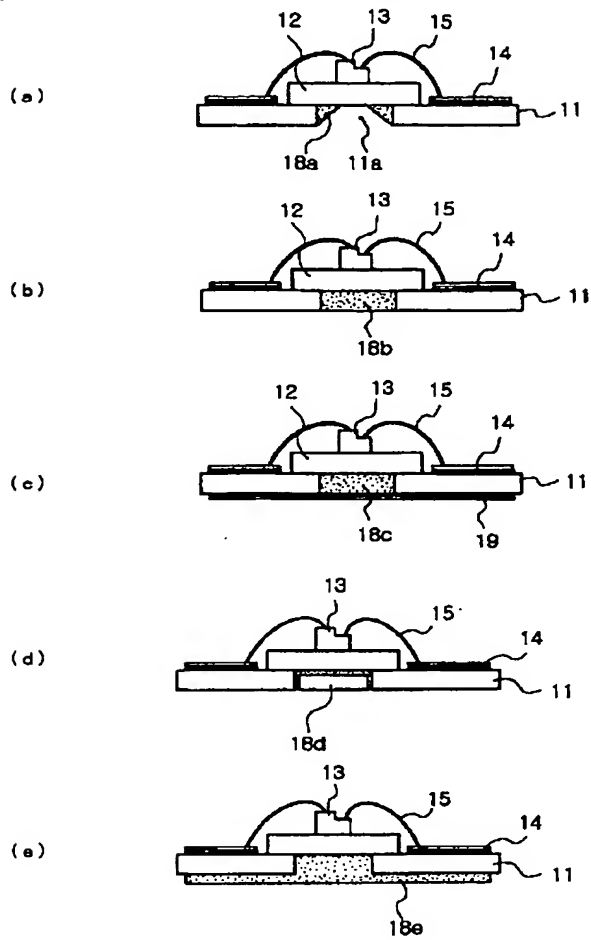
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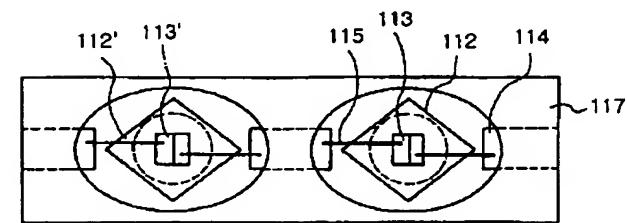
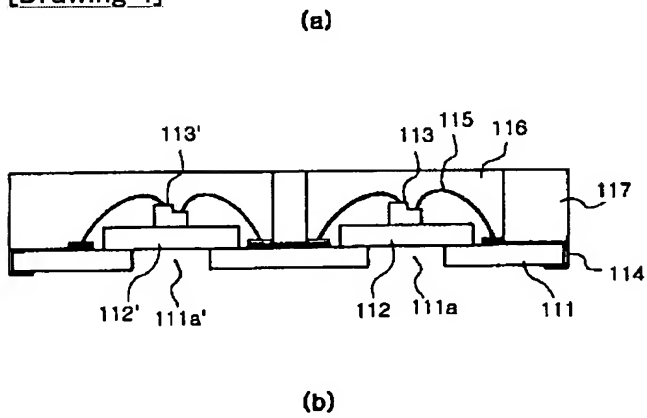
[Drawing 8]



[Drawing 3]

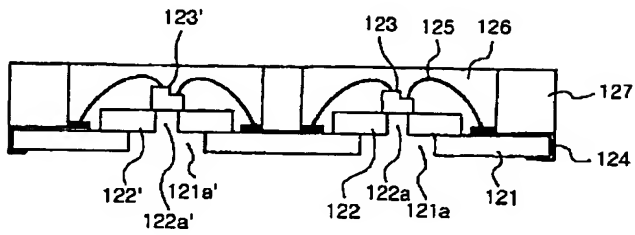


[Drawing 4]

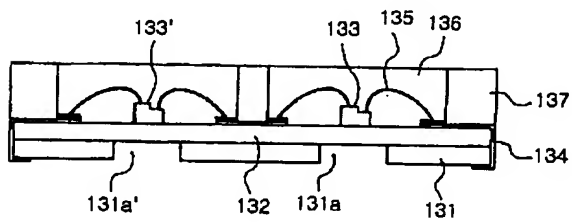


[Drawing 5]

(a)

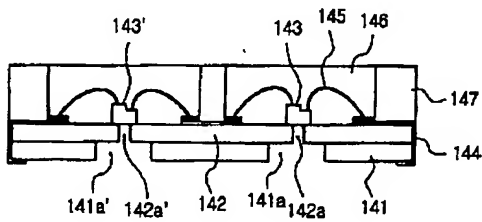


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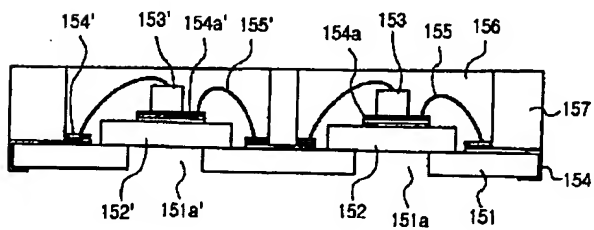


[Drawing 6]

(a)

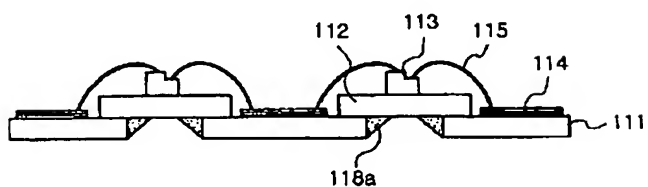


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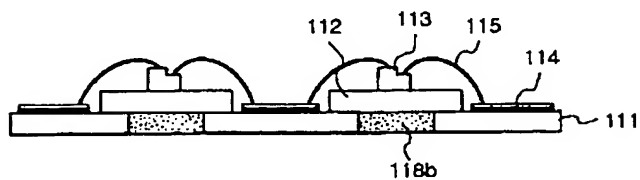


[Drawing 7]

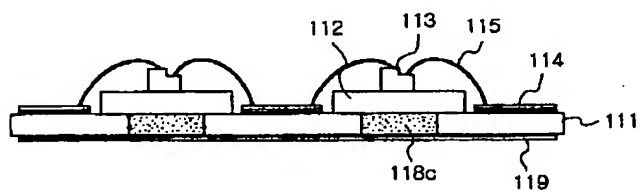
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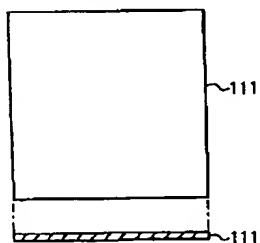


(c)

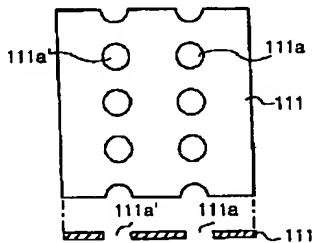


[Drawing 9]

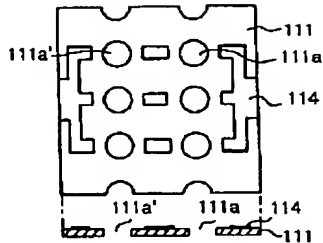
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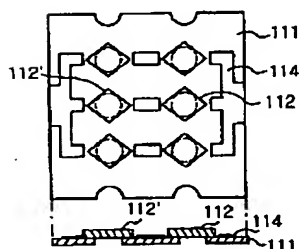
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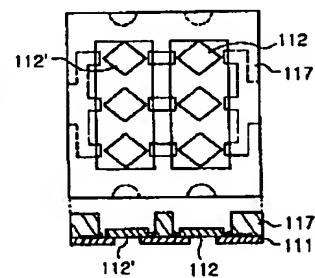
(c)



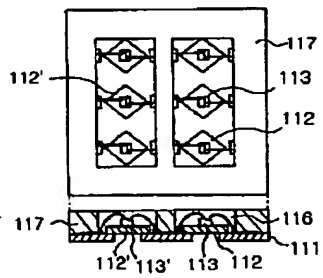
(d)



(e)

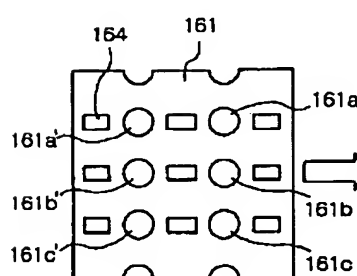


(f)

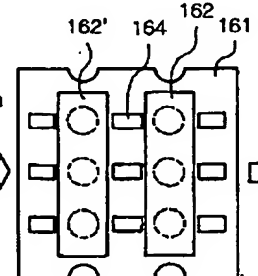


[Drawing 10]

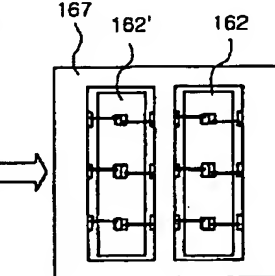
(a)



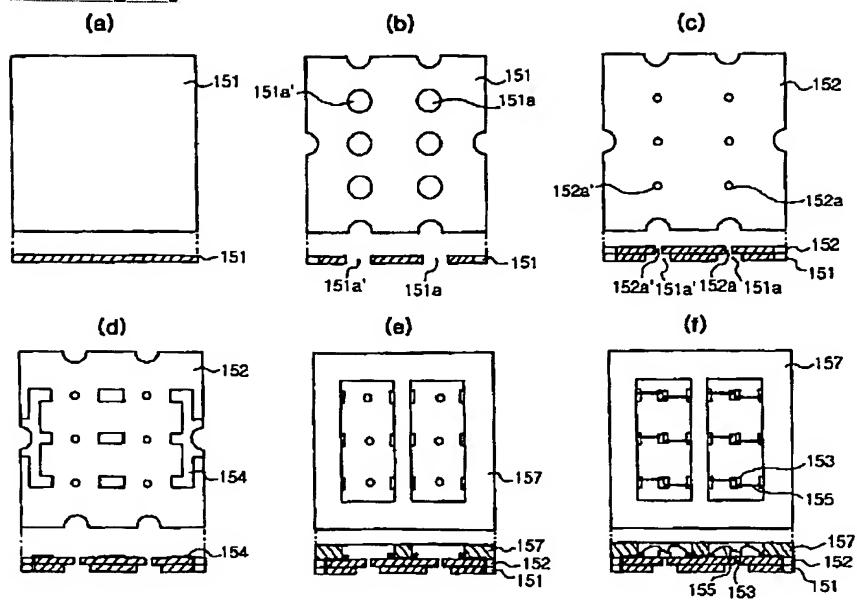
(b)



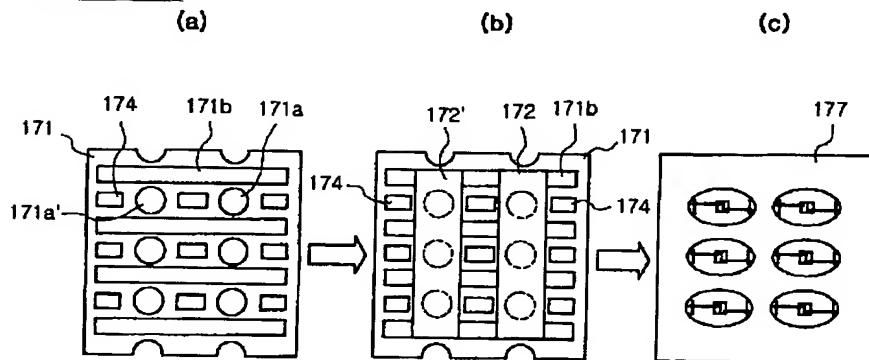
(c)



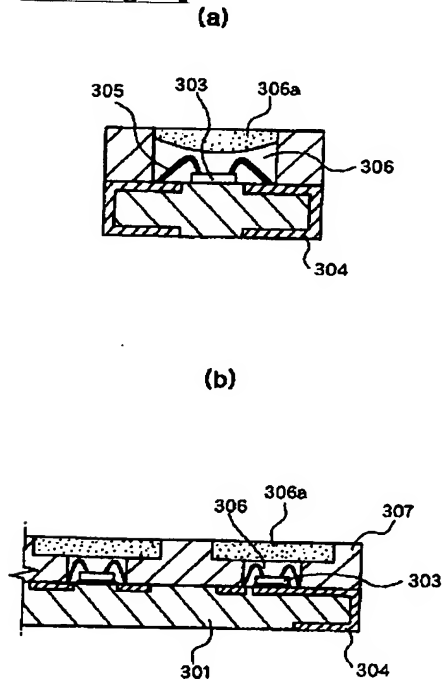
[Drawing 11]



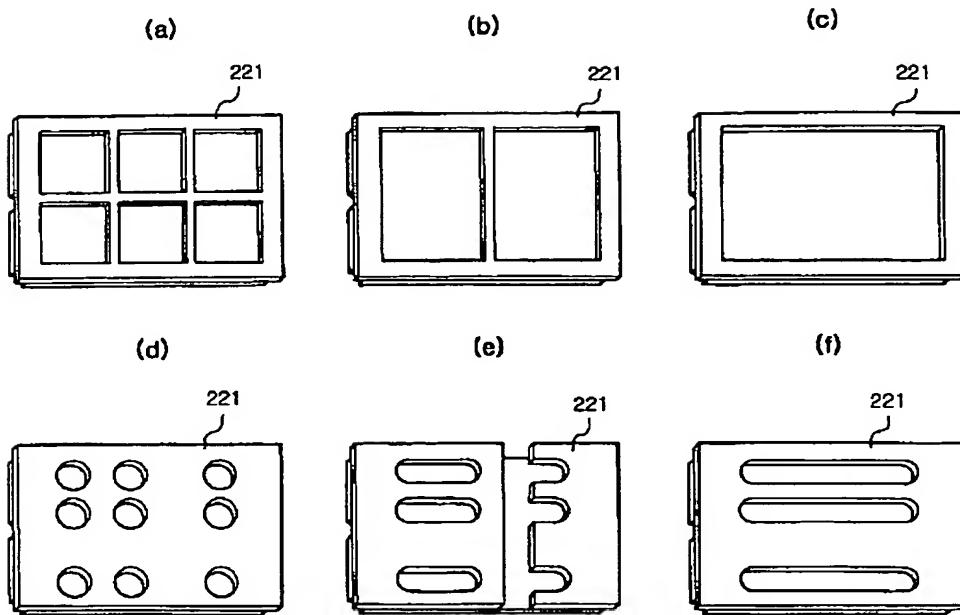
[Drawing 12]



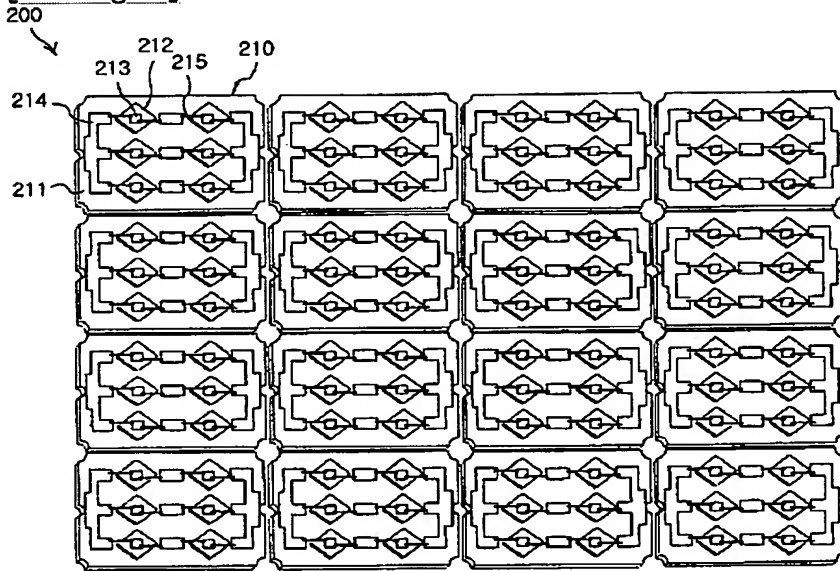
[Drawing 15]



[Drawing 13]



[Drawing 14]



[Translation done.]

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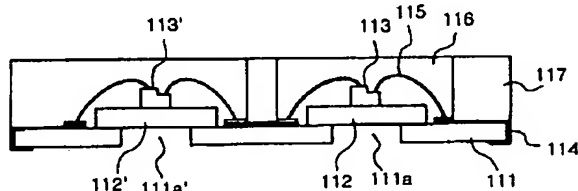
(54) 【発明の名称】 発光ダイオード及びこれを用いた発光装置とその製造方法

(57) 【要約】

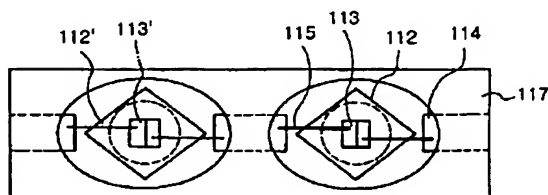
【課題】 本発明は発光ダイオード (LED)、これを用いた発光装置及びその製造工程を提供する。

【解決手段】 本発明による発光装置は様々な放熱設計により製造される。まず、多数個の放熱穴 (holes for heat sink) 111a、111a' を設けたセラミック基板111上に一定形態のバターン電極を設ける。セラミック基板上に補助セラミックシート112、112' を積層して各々の放熱穴を覆い、バターン電極の一部と補助セラミックシートの全部または一部とが露出されるよう上部セラミックシート117を積層する。前記補助セラミックシート上にはLED素子113、113' を実装する。各電極114とLED素子をワイヤー115によって電気的に接続し上部セラミックシート内のLED素子を絶縁樹脂で密封する。こうして製造される発光装置は放熱特性が向上され高密度でLED素子を大面積の基板に実装できる為に大面積のディスプレイ及び次世代照明設備に大変適する。

(a)



(b)



## 【特許請求の範囲】

【請求項1】 1個の放熱穴(a hole for heat sink)を設けるセラミック基板と、  
前記セラミック基板上に位置されLED素子を実装できるよう前記放熱穴を覆う一定形態の補助セラミックシートと、  
前記補助セラミックシート上で前記放熱穴を中心に一定パターンを形成する電極と、  
前記電極とワイヤーにより電氣的に接続され前記補助セラミックシート上に実装されるLED素子と、  
前記LED素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、  
前記上部セラミックシート内のLED素子を密封する絶縁層と、  
を備えたことを特徴とする発光ダイオード。  
【請求項2】 前記放熱穴の内側には前記補助セラミックシートとセラミック基板の接触部分に沿って金属ペーストが塗布されることを特徴とする請求項1記載の発光ダイオード。  
【請求項3】 前記放熱穴の内側には金属ペーストが充填されることを特徴とする請求項1記載の発光ダイオード。  
【請求項4】 前記放熱穴の内側に充填される金属ペーストの下部には前記セラミック基板に沿って金属板が付着されることを特徴とする請求項3記載の発光ダイオード。  
【請求項5】 前記放熱穴の内側には金属ペーストが充填され前記セラミック基板の下部には金属ペーストが塗布されることを特徴とする請求項3記載の発光ダイオード。  
【請求項6】 前記放熱穴の内側には金属塊(lump or slug)が挿入されることを特徴とする請求項1記載の発光ダイオード。  
【請求項7】 前記セラミック基板及び補助セラミックシート又は当該セラミック基板若しくは補助セラミックシートはアルミナまたはSiCであることを特徴とする請求項1記載の発光ダイオード。  
【請求項8】 前記電極はセラミック基板側からAg、Ni及びAu層で成ることを特徴とする請求項1記載の発光ダイオード。  
【請求項9】 前記絶縁層はエポキシまたはSi系透明性樹脂であることを特徴とする請求項1記載の発光ダイオード。  
【請求項10】 前記補助セラミックシートはLED素子の下部に1個の放熱穴を更に設けることを特徴とする請求項1記載の発光ダイオード。  
【請求項11】 1個の放熱穴を設けるセラミック基板を備える段階と、  
前記セラミック基板上に補助セラミックシートを積層する段階と、

前記補助セラミックシート上に前記放熱穴を中心に両側に一定形態のパターン電極を設ける段階と、  
前記パターン電極の一部が露出されるよう所定形状の開孔部(opening)を設ける上部セラミックシートを前記セラミック基板上に積層する段階と、  
前記積層されるセラミック基板を同時焼成(co-fire)する段階と、  
前記補助セラミック基板のパターン電極上に電極を設けた後に放熱穴と対向する位置でLED素子を補助セラミックシート上に実装する段階と、  
前記電極とLED素子を各々電氣的に接続させた後に前記上部セラミックシート内のLED素子を絶縁樹脂で密封する段階と、  
を有することを特徴とする発光ダイオードの製造方法。  
【請求項12】 前記セラミック基板及び補助セラミックシート又は当該セラミック基板若しくは補助セラミックシートはアルミナまたはSiCを用いることを特徴とする請求項11記載の発光ダイオードの製造方法。  
【請求項13】 前記電極はセラミック基板のAgペースト層にNi及びAu層をめっきして成ることを特徴とする請求項11記載の発光ダイオードの製造方法。  
【請求項14】 前記絶縁樹脂はエポキシまたはSi系透明性樹脂を用いて充填することを特徴とする請求項11記載の発光ダイオードの製造方法。  
【請求項15】 前記積層されるセラミック基板は800～1050℃で同時焼成されることを特徴とする請求項11記載の発光ダイオードの製造方法。  
【請求項16】 前記放熱穴の内側には前記補助セラミックシートとセラミック基板との接触部分に沿って金属ペーストを塗布することを特徴とする請求項11記載の発光ダイオードの製造方法。  
【請求項17】 前記放熱穴の内側には金属ペーストを充填することを特徴とする請求項11記載の発光ダイオードの製造方法。  
【請求項18】 前記放熱穴の内側に金属ペーストを充填し前記セラミック基板の下部に金属板を付着することを特徴とする請求項17記載の発光ダイオードの製造方法。  
【請求項19】 前記放熱穴の内側には金属ペーストを充填し前記セラミック基板の下部に金属ペーストを塗布することを特徴とする請求項17記載の発光ダイオードの製造方法。  
【請求項20】 前記放熱穴の内側には金属塊(lump or slug)を挿入することを特徴とする請求項11記載の発光ダイオードの製造方法。  
【請求項21】 前記補助セラミックシートには前記放熱穴より小さくLED素子より小さい他放熱穴を更に設けることを特徴とする請求項11記載の発光ダイオードの製造方法。  
【請求項22】 1個の放熱穴を設けて当該穴の両側に

一定形態の電極を設けるセラミック基板と、  
前記セラミック基板上に位置されLED素子を実装できるよう前記放熱穴を覆う一定形態の補助セラミックシートと、  
前記電極とワイヤーにより電氣的に接続され前記補助セラミックシート上に実装されるLED素子と、  
前記LED素子を囲みながらセラミック基板上に設けられる上部セラミックシートと、  
前記上部セラミックシート内のLED素子を密封する絶縁層と、  
を備えたことを特徴とする発光ダイオード。

【請求項23】 前記補助セラミックシートはLED素子の下部に1個の放熱穴を更に設けることを特徴とする請求項22記載の発光ダイオード。

【請求項24】 1個の放熱穴を設けるセラミックシートを備えて当該セラミックシート上に一定形態のパターン電極を設けてセラミック基板を製造する段階と、  
前記放熱穴を覆うよう前記セラミック基板上に一定形態の補助セラミックシートを積層する段階と、  
前記パターン電極の一部と補助セラミックシートの一部または全部が露出されるよう所定形状の開口部を設ける上部セラミックシートを前記セラミック基板上に積層する段階と、  
前記セラミック基板を同時焼成する段階と、  
前記セラミック基板のパターン電極上に電極を設けた後に前記補助セラミックシート上にLED素子を実装する段階と、  
前記電極とLED素子を電氣的に接続させた後に前記上部セラミックシート内のLED素子を絶縁樹脂で密封する段階と、  
を有することを特徴とする発光ダイオードの製造方法。

【請求項25】 1個の放熱穴を設けるセラミック基板と、  
前記セラミック基板上に位置されLED素子を実装できるよう前記放熱穴を覆う補助セラミックシートと、  
前記補助セラミックシート上で放熱穴を中心に両側に設けられる一定形態の電極と、  
前記放熱穴と対向して補助セラミックシートとLEDとの間に位置し補助セラミックシート上に設けられる一定パターンの他電極と、  
前記補助セラミックシート上の他電極上に実装され補助セラミック基板の電極とワイヤーにより電氣的に接続されるLED素子と、  
前記LED素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、  
前記上部セラミックシート内のLED素子を密封する絶縁層と、を備えたことを特徴とする発光ダイオード。

【請求項26】 多数個の放熱穴(holes for heat sink)を設けるセラミック基板と、  
前記セラミック基板上に位置されLED素子を実装でき

るよう前記放熱穴を覆う一定形態の補助セラミックシートと、  
前記補助セラミックシート上で前記放熱穴を中心に設けられる一定パターンの電極と、  
前記電極とワイヤーにより電氣的に接続され前記補助セラミックシート上に実装されるLED素子と、  
前記LED素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、  
前記上部セラミックシート内のLED素子を密封する絶縁層と、  
を備えたことを特徴とする発光ダイオードを用いた発光装置。

【請求項27】 前記補助セラミックシートは各々のLED素子の下部に1個の放熱穴を更に設けることを特徴とする請求項26記載の発光装置。

【請求項28】 多数個の放熱穴を設けるセラミック基板を備える段階と、  
前記セラミック基板上に補助セラミックシートを積層する段階と、  
前記補助セラミックシート上で前記放熱穴を中心に両側に一定形態のパターン電極を設ける段階と、  
前記パターン電極の一部が露出されるよう所定形状の開口部を設ける上部セラミックシートを補助セラミックシート上に積層する段階と、  
前記積層されるセラミック基板を同時焼成する段階と、  
前記補助セラミックシートのパターン電極上に電極を設けた後に放熱穴と対向する位置でLED素子を補助セラミックシート上に実装する段階と、  
前記電極とLED素子を各々電氣的に接続させた後に前記上部セラミックシート内のLED素子を絶縁樹脂で密封する段階と、  
を有することを特徴とする発光装置の製造方法。

【請求項29】 前記補助セラミックシートには前記放熱穴より小さくLED素子より小さい他放熱穴を更に設けることを特徴とする請求項28記載の発光装置の製造方法。

【請求項30】 多数個の放熱穴を設け各穴の両側に一定形態の電極を設けるセラミック基板と、  
前記セラミック基板上に位置されLED素子を実装できるよう前記各々の放熱穴を覆う一定形態の補助セラミックシートと、  
前記各電極とワイヤーにより電氣的に接続され前記補助セラミックシート上に各々実装される多数個のLED素子と、  
前記LED素子を囲みながらセラミック基板上に設けられる上部セラミックシートと、  
前記上部セラミックシート内のLED素子を密封する絶縁層と、  
を備えたことを特徴とする発光ダイオードを用いた発光装置。

【請求項31】 前記補助セラミックシートはセラミック基板上に位置され各々1個の放熱穴を覆うよう独立した補助セラミックシートであることを特徴とする請求項30記載の発光ダイオードを用いた発光装置。

【請求項32】 前記補助セラミックシートはセラミック基板上に位置され各々少なくとも1個以上の放熱穴を覆うよう独立した補助セラミックシートであることを特徴とする請求項30記載の発光ダイオードを用いた発光装置。

【請求項33】 多数個の放熱穴を設けるセラミックシートを備え当該セラミックシート上に一定形態のパターン電極を設けてセラミック基板を製造する段階と、前記各々の放熱穴を覆うよう前記セラミック基板上に一定形態の補助セラミックシートを積層する段階と、前記パターン電極の一部と補助セラミックシートの一部または全部が露出されるよう所定形状の開開口部を設ける上部セラミックシートをセラミック基板上に積層する段階と、

前記セラミック基板を同時焼成する段階と、前記セラミック基板のパターン電極上に電極を設けた後に前記補助セラミックシート上にLED素子を各々実装する段階と、

前記電極とLED素子を各々電氣的に接続させた後に前記上部セラミックシート内のLED素子を絶縁樹脂で密封する段階と、を有することを特徴とする発光ダイオードを用いた発光装置の製造方法。

【請求項34】 前記セラミック基板上には各々1個の放熱穴を覆うよう独立した補助セラミックシートを積層することを特徴とする請求項33記載の発光ダイオードを用いた発光装置の製造方法。

【請求項35】 前記セラミック基板上には少なくとも1個以上の放熱穴を覆うよう独立した補助セラミックシートを積層することを特徴とする請求項33記載の発光ダイオードを用いた発光装置の製造方法。

【請求項36】 前記セラミック基板は放熱穴とは別途の放熱開口部(openings for heat sink)を更に設けることを特徴とする請求項33記載の発光ダイオードを用いた発光装置の製造方法。

【請求項37】 前記補助セラミックシートには各々のLED素子の下部に1個の放熱穴を更に設けることを特徴とする請求項33記載の発光ダイオードを用いた発光装置の製造方法。

【請求項38】 多数個の放熱穴を設けるセラミック基板と、

前記セラミック基板上に位置されLED素子を実装できるよう前記放熱穴を覆う補助セラミックシートと、前記補助セラミックシート上で放熱穴を中心に両側に設けられる一定形態の電極と、

前記放熱穴と対向し前記補助セラミックシートとLED

との間に位置して補助セラミックシート上に設けられる一定パターン他電極と、

前記補助セラミックシート上の他電極上に実装され補助セラミック基板の電極とワイヤーにより電氣的に接続されるLED素子と、

前記LED素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、

前記上部セラミックシート内のLED素子を密封する絶縁層と、

を備えたことを特徴とする発光ダイオードを用いた発光装置。

【請求項39】 請求項26記載の発光ダイオードを用いた発光装置を多数個備えることを特徴とする大面積の発光ユニットアセンブリ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は発光ダイオード、これを用いた発光装置及びその製造方法に関するものとして、詳しくは放熱特性に優れた大面積のディスプレイ及び照明設備に適する高密度実装用発光ダイオード及びこれを用いた発光装置とその製造方法に関するものである。

【0002】

【従来の技術】発光ダイオード(以下、LEDという。)は固体発光表示素子(indicator)の一種である。LEDは光の3原色である赤(R)、緑(G)、青(B)を含んだ単色LEDから、より多様な分野に応用できる白色光(W)LEDが具現された。最近ではランプ形態のLEDから基板に実装が容易なチップ(SMD)形態のLEDに発展し大面積の高密度LED実装がより可能になった。これに伴ってLEDの応用分野は一般表示装置からディスプレイのバックライト用発光源はもちろん、白熱電球や蛍光灯、街灯を代替できる次世代照明設備へと漸次その活用範囲が拡大しつつある。LED照明設備の場合、一般蛍光灯とは異なって点灯回路が単純でインバータ回路と鉄心安定器が不要である。更に、LEDを用いた照明設備は蛍光灯に比して電力消費が少なく寿命が10倍以上長い為維持や補修費を省けるという長所がある。

【0003】前記照明設備に応用される白色LEDの代表例として、特開2000-315826号公報にはLEDと蛍光体(phosphor)とから成る発光素子が開示されている。前記特開2000-315826号公報による発光素子は図15(a)、(b)に示す如く、セラミック基板301に実装された青色LED303、青色LEDチップ303を覆っている第1透明性コーティング部306、前記LEDチップ及び第1透明性コーティング部上に配置されて蛍光物質を含有する第2透明性コーティング部306a及び前記LEDチップとワイヤー305により電氣的に接続された電極304とを含んで成る。こうした発光装置はLEDチップから放たれる可視光と、該可視光を吸収し異なる可視光を放つ蛍光物質か

ら放たれる光との混合光である白色光を照射する。前記発光装置は発光効率が優れ均一な白色の混色光を誘導できる。この他にも白色光を具現できるLEDは多数提案されている(米国特許第5,998,925号、第6,069,440号)。

【0004】

【発明が解決しようとする課題】ところで、こうしたLEDを用いた応用製品の特性劣化及び故障に係わる最大の原因に挙げられるものは熱的ストレス(thermal stress)である。前記提案された諸LEDチップはもちろん一般のLEDチップを図15(b)の如く、直接同一基板上に高密度実装し信号灯や照明設備等に用いる場合にLEDチップはより多くの熱を放散し、総発光面積に比例して放熱量が増大する傾向を呈する。特に、青色LEDの場合、他の色の高輝度LEDに比して相対的に高い駆動電圧を有する為に温度が増加する現象を見せる。その上、照明設備の面積が大きいくほど、LEDチップが高密度に実装されるほど、LEDの特性劣化及び故障の発生がより甚だしいことと思われる。また、既存の発光装置は図15(b)の如き構造を有し放熱特性が良好ではなく大面積の高密度LEDチップ実装に限界がある。

【0005】本発明は、このような従来の課題に鑑みてなされたものであり、その目的は、放熱性が優れ高密度実装に適したLEDを提供することである。本発明の異なる目的は、こうしたLEDを容易に製造せしめる方法を提供することである。

【0006】本発明の更に異なる目的は、前記LEDを用いて大面積に高密度実装する場合にも放熱特性の優れた発光装置を提供することである。また、本発明の他の目的は、こうした発光装置を容易に製造せしめる方法を提供することである。そして、本発明の更に異なる他の目的は、こうした発光装置を用いた大面積の発光ユニットアセンブリー(light emitting unit assembly for large area)を提供することである。

【0007】

【課題を解決するための手段】前記目的を成し遂げる為に、本発明によるLEDは、1個の放熱穴(a hole for heat sink)を設けるセラミック基板と、前記セラミック基板上に位置されLED素子を実装できるよう前記放熱穴を覆う一定形態の補助セラミックシートと、前記補助セラミックシート上で前記放熱穴を中心に一定パターンを形成する電極と、前記電極とワイヤーにより電気的に接続され前記補助セラミックシート上に実装されるLED素子と、前記LED素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、前記上部セラミックシート内のLED素子を密封する絶縁層とを備えたことを要旨とする。従って、放熱性が優れ高密度実装に適したものとなる。前記放熱穴の内側には前記補助セラミックシートとセラミック基板の接触部分に沿って金属ペーストが塗布されることを要旨とする。前記

放熱穴の内側には金属ペーストが充填されることを要旨とする。前記放熱穴の内側に充填される金属ペーストの下部には前記セラミック基板に沿って金属板が付着されることを要旨とする。前記放熱穴の内側には金属ペーストが充填され前記セラミック基板の下部には金属ペーストが塗布されることを要旨とする。前記放熱穴の内側には金属塊(lump or slug)が挿入されることを要旨とする。前記セラミック基板及び補助セラミックシート又は当該セラミック基板若しくは補助セラミックシートはアルミナまたはSiCであることを要旨とする。前記電極はセラミック基板側からAg、Ni及びAu層で成ることを要旨とする。前記絶縁層はエポキシまたはSi系透明性樹脂であることを要旨とする。前記補助セラミックシートはLED素子の下部に1個の放熱穴を更に設けることを要旨とする。

【0008】また、前記目的を成し遂げる為に、本発明によるLEDの製造方法は、1個の放熱穴を設けるセラミック基板を備える段階と、前記セラミック基板上に補助セラミックシートを積層する段階と、前記補助セラミックシート上に前記放熱穴を中心に両側に一定形態のパターン電極を設ける段階と、前記パターン電極の一部が露出されるよう所定形状の開開口部(opening)を設ける上部セラミックシートを前記セラミック基板上に積層する段階と、前記積層されるセラミック基板を同時焼成(co-fire)する段階と、前記補助セラミック基板のパターン電極上に電極を設けた後に放熱穴と対向する位置でLED素子を補助セラミックシート上に実装する段階と、前記電極とLED素子を各々電気的に接続させた後に前記上部セラミックシート内のLED素子を絶縁樹脂で密封する段階とを備えたことを要旨とする。従って、放熱性が優れ高密度実装に適したLEDを容易に製造せしめる。前記セラミック基板及び補助セラミックシート又は当該セラミック基板若しくは補助セラミックシートはアルミナまたはSiCを用いることを要旨とする。前記電極はセラミック基板上のAgペースト層にNi及びAu層をめっきして成ることを要旨とする。前記絶縁樹脂はエポキシまたはSi系透明性樹脂を用いて充填することを要旨とする。前記積層されるセラミック基板は800～1050℃で同時焼成されることを要旨とする。前記放熱穴の内側には前記補助セラミックシートとセラミック基板との接触部分に沿って金属ペーストを塗布することを要旨とする。前記放熱穴の内側には金属ペーストを充填することを要旨とする。前記放熱穴の内側に金属ペーストを充填し前記セラミック基板の下部に金属板を付着することを要旨とする。前記放熱穴の内側には金属ペーストを充填し前記セラミック基板の下部に金属ペーストを塗布することを要旨とする。前記放熱穴の内側には金属塊(lump or slug)を挿入することを要旨とする。前記補助セラミックシートには前記放熱穴より小さくLED素子より小さい他放熱穴を更に設けることを要旨とする。

る。

【0009】更に、前記目的を成し遂げる為に、本発明によるLEDは、1個の放熱穴(a hole for heat sink)を設け該穴の両側に一定形態の電極を設けたセラミック基板と、前記セラミック基板上に位置されLED素子を実装できるよう前記放熱穴を覆う一定形態の補助セラミックシートと、前記電極とワイヤーによって電氣的に接続され前記補助セラミックシート上に実装されたLED素子と、前記LED素子を囲みながらセラミック基板上に設けられた上部セラミックシートと、及び前記上部セラミックシート内のLED素子を密封している絶縁層とを含んで成る。従って、放熱性が優れ高密度実装に適したものとなる。前記補助セラミックシートはLED素子の下部に1個の放熱穴を更に設けることを要旨とする。

【0010】また、前記目的を成し遂げる為に、本発明によるLEDの製造方法は、1個の放熱穴(a hole for heat sink)を設けたセラミックシートを備え当該セラミックシート上に一定形態のパターン電極を設けセラミック基板を製造する段階と、前記放熱穴を覆うよう前記セラミック基板上に一定形態の補助セラミックシートを積層する段階と、前記パターン電極の一部と補助セラミックシートの一部または全部が露出されるよう所定形状の開口部(opening)を設けた上部セラミックシートをセラミック基板上に積層する段階と、前記セラミック基板を同時焼成(co-fire)する段階と、前記セラミック基板のパターン電極上に電極を設けた後、前記補助セラミックシート上にLED素子を実装する段階と、及び前記電極とLED素子を電氣的に接続させた後、前記上部セラミックシート内のLED素子を絶縁樹脂で密封する段階とを含んで成る。従って、放熱性が優れ高密度実装に適したLEDを容易に製造せしめる。

【0011】更に、前記目的を成し遂げる為に、本発明によるLEDは、1個の放熱穴を設けるセラミック基板と、前記セラミック基板上に位置されLED素子を実装できるよう前記放熱穴を覆う補助セラミックシートと、前記補助セラミックシート上で放熱穴を中心に両側に設けられる一定形態の電極と、前記放熱穴と対向して補助セラミックシートとLEDとの間に位置し補助セラミックシート上に設けられる一定パターン他電極と、前記補助セラミックシート上の他電極上に実装され補助セラミック基板の電極とワイヤーにより電氣的に接続されるLED素子と、前記LED素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、前記上部セラミックシート内のLED素子を密封する絶縁層とを備えたことを要旨とする。従って、放熱性が優れ高密度実装に適したものとなる。

【0012】前記他の目的を成し遂げる為に、本発明によるLEDを用いた発光装置は、多数個の放熱穴(holes for heat sink)を設けるセラミック基板と、前記セラミック基板上に位置されLED素子を実装できるよう前

記放熱穴を覆う一定形態の補助セラミックシートと、前記補助セラミックシート上で前記放熱穴を中心に設けられる一定パターンの電極と、前記電極とワイヤーにより電氣的に接続され前記補助セラミックシート上に実装されるLED素子と、前記LED素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、前記上部セラミックシート内のLED素子を密封する絶縁層とを備えたことを要旨とする。従って、前記LEDを用いて大面積に高密度実装する場合にも放熱特性の優れたものとする。前記補助セラミックシートは各々のLED素子の下部に1個の放熱穴を更に設けることを要旨とする。

【0013】また、前記他の目的を成し遂げる為に、本発明によるLEDを用いた発光装置の製造方法は、多数個の放熱穴を設けるセラミック基板を備える段階と、前記セラミック基板上に補助セラミックシートを積層する段階と、前記補助セラミックシート上で前記放熱穴を中心に両側に一定形態のパターン電極を設ける段階と、前記パターン電極の一部が露出されるよう所定形状の開口部を設ける上部セラミックシートを補助セラミックシート上に積層する段階と、前記積層されるセラミック基板を同時焼成する段階と、前記補助セラミックシートのパターン電極上に電極を設けた後に放熱穴と対向する位置でLED素子を補助セラミックシート上に実装する段階と、前記電極とLED素子を各々電氣的に接続させた後に前記上部セラミックシート内のLED素子を絶縁樹脂で密封する段階とを有することを要旨とする。従って、前記LEDを用いて大面積に高密度実装する場合にも放熱特性の優れたものとする発光装置を容易に製造せしめる。前記補助セラミックシートには前記放熱穴より小さくLED素子より小さい他放熱穴を更に設けることを要旨とする。

【0014】更に、前記他の目的を成し遂げる為に、本発明によるLEDを用いた発光装置は、多数個の放熱穴(holes for heat sink)を設け各穴の両側に一定形態の電極を設けたセラミック基板と、前記セラミック基板上に位置されLED素子を実装できるよう前記各放熱穴を覆う一定形態の補助セラミックシートと、前記各電極とワイヤーによって電氣的に接続され前記補助セラミックシート上に各々実装された多数個のLED素子と、前記多数個のLED素子を囲みながらセラミック基板上に設けられた上部セラミックシートと、及び前記上部セラミックシート内のLED素子を密封する絶縁層とを含んで成る。従って、前記LEDを用いて大面積に高密度実装する場合にも放熱特性の優れたものとする。前記補助セラミックシートはセラミック基板上に位置され各々1個の放熱穴を覆うよう独立した補助セラミックシートであることを要旨とする。前記補助セラミックシートはセラミック基板上に位置され各々少なくとも1個以上の放熱穴を覆うよう独立した補助セラミックシートであること

を要旨とする。

【0015】また、前記他の目的を成し遂げる為に、本発明によるLEDを用いた発光装置の製造方法は、多数個の放熱穴を設けたセラミックシートを備え当該セラミックシート上に一定形態のパターン電極を設けてセラミック基板を製造する段階と、前記各放熱穴を覆うよう前記セラミック基板上に一定形態の補助セラミックシートを積層する段階と、前記パターン電極の一部と補助セラミックシートの一部または全部が露出されるよう所定形状の開開口部を設けた上部セラミックシートをセラミック基板上に積層する段階と、前記セラミック基板を同時焼成する段階と、前記セラミック基板のパターン電極上に電極を設けた後、前記補助セラミックシート上に多数個のLED素子を各々実装する段階と、前記電極とLED素子を各々電氣的に接続させた後、前記上部セラミックシート内のLED素子を絶縁樹脂で密封する段階とを含んで成る。従って、前記LEDを用いて大面積に高密度実装する場合にも放熱特性の優れたものとする発光装置を容易に製造せしめる。前記セラミック基板上には各々1個の放熱穴を覆うよう独立した補助セラミックシートを積層することを要旨とする。前記セラミック基板上には少なくとも1個以上の放熱穴を覆うよう独立した補助セラミックシートを積層することを要旨とする。前記セラミック基板は放熱穴とは別途の放熱開口部(openings for heat sink)を更に設けることを要旨とする。前記補助セラミックシートには各々のLED素子の下部に1個の放熱穴を更に設けることを要旨とする。

【0016】更に、前記目的を成し遂げる為に、本発明によるLEDを用いた発光装置は、多数個の放熱穴を設けるセラミック基板と、前記セラミック基板上に位置されLED素子を実装できるよう前記放熱穴を覆う補助セラミックシートと、前記補助セラミックシート上で放熱穴を中心に両側に設けられる一定形態の電極と、前記放熱穴と対向し前記補助セラミックシートとLEDとの間に位置して補助セラミックシート上に設けられる一定パターンの他電極と、前記補助セラミックシート上の他電極上に実装され補助セラミック基板の電極とワイヤーにより電氣的に接続されるLED素子と、前記LED素子を囲みながら補助セラミックシート上に積層される上部セラミックシートと、前記上部セラミックシート内のLED素子を密封する絶縁層とを備えたことを要旨とする。従って、前記LEDを用いて大面積に高密度実装する場合にも放熱特性の優れたものとする。

【0017】前記更に他の目的を成し遂げる為に、本発明によるLEDを用いた発光ユニットアセンブリー発光装置は、請求項26記載の発光ダイオードを用いた発光装置を多数個備えることを要旨とする。従って、大面積の発光ユニットアセンブリーを実現できる。

【0018】

【発明の実施の形態】以下、本発明を詳細に説明する。

本発明は多様な放熱設計によりLED及びこれを用いた発光装置の熱的ストレスを最小化したものである。これに伴って、本発明はLED特性を向上させ次世代照明設備の発光源として大変有用なものとなる。

【0019】(LED及びその製造方法)図1は本発明によるLEDの一例を示す。図1(a)は本発明の一実施の形態であるLEDの断面構成図で、図1(b)はその平面図である。本発明によるLEDは図1(a)、

(b)に示す如く、大別するとセラミック基板11、前記セラミック基板11上に積層された補助セラミックシート12、上部セラミックシート16、発光素子13及び電極14を含んで成る。

【0020】本実施の形態において前記セラミック基板11は1個の放熱穴11aを備える。更に、セラミック基板11の表面上には前記放熱穴11aの両側に一定形態のパターン電極を設ける。前記放熱穴はLED素子の下部に配置されLED素子から発生した熱を直接空中に放出しLEDの熱的ストレスを最小化するのに大変適している。もちろん放熱穴は必ずしも円形の必要はなく四角または多角形等如何なる形状でも構わない。前記セラミック基板はLED素子を高密度実装できる基板であれば如何なるものでも構わない。例えば、こうしたセラミック基板としてアルミナ(alumina)、水晶(quartz)、カルシウムジルコネート(calcium zirconate)、橄欖石(forsterite)、SiC、黒鉛、熔融シリカ(fused silica)、ムライト(mullite)、董青石(cordierite)、ジルコニア(zirconia)、ベリリア(beryllia)及び窒化アルミニウム(aluminum nitride)等を挙げることができる。従って、セラミック基板の材質は特別限定されないが中でもアルミナまたはSiC材質が適している。より好ましくはアルミナを用いることである。アルミナセラミックは電気絶縁性および熱伝導率が高い。更に、アルミナセラミックは耐熱性、耐化学性及び機械的強度が優れており、特に放射線放出が少ないという長所を有する。更に、アルミナセラミックはその上に金属導体配線パターンを設け焼成工程により積層型セラミックパッケージ(multi-layer ceramic package; MLP)として用いることができる。こうしたパッケージとして用いられる場合、気密性が優れている。

【0021】前記補助セラミックシート12は前記セラミック基板上に位置されLED素子を実装できるよう前記放熱穴を覆う。補助セラミックシート12も前記と同様にアルミナまたはSiC材質を用いるのが最も適している。前記補助セラミックシートはその形態や形状に拘わらず多様に構成され得る。図1(b)では単に四角または菱形で示されているが、以後多様に提示される如く、様々な形態から成り得る。発光素子のLED13は前記補助セラミックシート上に実装されセラミック基板上に設けられた電極14とワイヤー15やその他配線パターン等によって電氣的に接続される。本発明によるL

EDはLED素子の形態や種類に拘わらず適用できる。従って、RGB LEDはもちろん白色光LEDのみならず多様な色相のLED素子にも適用し得ることは言うまでもない。LED素子はセラミック基板の周囲に沿ってセラミック基板上に設けられた上部セラミックシート17により囲まれて絶縁層16により密封される。

【0022】前記絶縁層16は外部の物理的・化学的侵蝕からLED素子を保護し、LED素子から照射される光を通過させるよう透明材質から成る。好ましく絶縁層の材質としてはエポキシまたはSi系透明性樹脂等を挙げることができる。

【0023】図2(a)、(b)は本発明によるLEDの異なる実施の形態を示す。図2(a)、(b)の各種LEDにおいて各符合は理解し易いよう図1(a)、

(b)に対応している。先ず、図2(a)はLED素子23が実装された前記補助セラミックシート22に他放熱穴22aが設けられたLEDを示す。前記他放熱穴22aはLED素子23より小さいことは当然である。更に、セラミック基板21の放熱穴21aより小さく設けるのが好ましい。図2(a)のLEDはLED素子23が直接空気と接触する為に図1に示すLEDに比して放熱特性が優れることが予測される。

【0024】図2(b)には本発明の更に異なる実施の形態のLEDを例示する。図2(a)に示すLEDとは異なって、補助セラミックシート32がセラミック基板31全体に互って積層された構造から成る。更に、電極34もセラミック基板でない補助セラミックシート32に位置する。こうした構造から成るLEDは以後に説明する如く製造工程において大きな利点を有する。

【0025】更に、図2(c)に例示するLEDは図2(b)のLED構造において補助セラミックシート42に1個の放熱穴42aを更に設けている。図2(c)に例示するLEDは図2(a)と図2(b)に例示したLEDの長所を全て備えている。即ち、LEDから発生した熱の放出が容易なばかりでなく製造工程においても大きな利点を有する。

【0026】以上例示したLEDは、LED素子として窒化物化合物を用いた青色または白色光LED素子の使用にあたって適した電極を有する場合に該当する。しかし、他の半導体化合物、即ちGaAs、GaP、SiC、ZnSe等から成るLED素子の場合は基板自体の電気伝導度に因り電界印加方式がLED素子の上・下部により行われる。従って、この場合のLED素子は下方に下部電極が設けられる。図2(d)にはこうしたLED素子に適するLEDの一例を示している。図2(d)に例示するLEDは先に例示したLEDとは電極構造が大きく異なる。従って、補助セラミックシート52上に実装されたLED素子53は下部の他電極54aがワイヤー55等により電極54と電気的に接続され得る。この場合、セラミック基板51に放熱穴51aを設けてい

るが補助セラミックシートにも放熱穴を設けることができる。

【0027】以上説明したLEDは多様な放熱設計により効果的にLEDの熱的ストレスを抑えることができるが、各々のLEDは放熱穴に導電性材料を塗布したり充填する方法でより効果的に放熱特性を増進させ得る。図3には図1のLEDに適用された方式を例示する。その一方式として図3(a)は放熱穴11aの内側に補助セラミックシート12とセラミック基板11との接触面に沿って金属ペースト18aが塗布されたLEDを示す。更に、図3(b)は前記放熱穴11aの内側に金属ペースト18bが充填されたLEDを例示する。更に、図3(c)は放熱穴11aの内側に金属ペーストが充填された図3(b)のLEDの下部にセラミック基板11に沿って金属板19が付着されたLEDである。図3(d)は放熱穴11aの内側に金属塊(lump or slug)18dが挿入されて金属ペーストで接着されたLEDを示す。図3(e)に示したLEDは放熱穴11aの内側に金属ペーストが充填された上にセラミック基板11の下部に沿って全て金属ペースト18eが塗布された構造である。これらLEDは全て放熱穴11aにより熱放出がより容易に行う為に放熱穴だけ設ける場合に比して放熱特性が優れている。こうした構造はもちろん図1に例示したLEDのみならず多様に放熱設計された図2のLEDにも同一に適用し得ることは言うまでもない。

【0028】こうした多様な放熱構造を有するLEDは次の如き工程を経て製造される。即ち、例えば、図1のLEDの製造方法は、先ず1個の放熱穴11aを設けたセラミックシート11を備える。前記セラミックシートの放熱穴はバンチングにより簡単に設けることができる。次いで、セラミックシート上にはスクリーン印刷方式等により一定形態のパターン電極14を設ける。前記パターン電極は設計により多様に変更し得ることは言うまでもない。本発明においてはパターン電極としてAg含有ペーストが適する。前記セラミック基板は1個または2個以上のセラミックシートを積層して構成することができる。更に、セラミック基板には必要により他の配線パターンを設けることができる。前記セラミック基板を備えた後には前記放熱穴を覆うことのできる一定形態の補助セラミックシート12を積層する。図2(b)に例示されたLEDの場合、補助セラミックシート32をセラミック基板31と同一の大きさにすればよい。

【0029】次いで、前記パターン電極の一部と補助セラミックシートの一部または全部が露出されるよう所定形状の開口部(opening)が設けられた上部セラミックシート17を備え、これをセラミック基板上に積層する。その後、前記セラミック基板は同時焼成を行う。この際、同時焼成は約800~1050℃で行うことが好ましい。

【0030】続いて、前記セラミック基板のパターン電

極上にめっきにより電極を設ける。本発明において電極はセラミック基板上のAgペースト層にNi及びAuを順次にめっきすることが好ましい。前記電極を設けた後には補助セラミックシート12上に設けられたLED素子13を実装する。その後、前記電極とLED素子とをワイヤー15により電気的に接続させてから、前記上部セラミックシート17内のLED素子13を絶縁樹脂で密封する。

【0031】(発光装置及びその製造方法)一方、本発明は前記の多様な放熱設計により得られる基本的な単位発光素子であるLEDを用いて熱的ストレスが大幅に低減される発光装置を提供する。本発明の発光装置は、前記単品のLEDを1個のPCB基板上に実装せず、LED素子を一体化したパッケージ内で連続する金属パターン電極上に実装したものである。

【0032】図4は本発明のLEDを用いた発光装置の一例を示す。図4(a)は本発明の一実施の形態である発光装置の断面構成で、図4(b)はその平面図である。本発明による発光装置は図4に示す如く、大別してセラミック基板111、前記セラミック基板上に積層された補助セラミックシート112、112'、上部セラミックシート116、発光素子113、113'及び電極114を含んで成る。こうした発光装置は図1の多数のLEDを組合せた如き構造を有する。

【0033】具体的に、本実施の形態において前記セラミック基板111は多数個の放熱穴111a、111a'を設けている。更に、セラミック基板111の表面上には前記放熱穴111a、111a'の両側に一定形態のパターン電極が設けられている。前述のとおり、前記放熱穴はLED素子の下部に配置されLED素子から発生した熱を直接空中に放出してLEDの熱的ストレスを最小化するのに大変適している。もちろん放熱穴は如何なる形状でも構わない。セラミック基板はLED素子を高密度実装し得る基板であれば如何なるものでもよい。セラミック基板の材質は前述のとおり、特別限定されはしないが中でもアルミナまたはSiC材質が適当である。より好ましくはアルミナを用いることである。

【0034】前記補助セラミックシート112、112'は前記セラミック基板上に位置され各々のLED素子を実装できるよう前記放熱穴を覆っている。補助セラミックシート112、112'も前記と同様にアルミナまたはSiC材質を用いることが最も適する。前記補助セラミックシートはその形態や形状に拘わらず多様に構成することができる。図1(b)においては単に四角または菱形から成っているが、以後に多様に提示する如く、様々な形態から成ることができる。更に、図4

(a)において補助セラミックシートはセラミック基板111上に位置され各々1個の放熱穴111aを覆う独立した補助セラミックシートや、各々少なくとも1個以上の放熱穴を覆うよう独立した補助セラミックシートで

ある(図2(b)、図2(c)、図11(b)及び図12(b)参照)。

【0035】発光素子であるLED113、113'は前記補助セラミックシート上に実装され、セラミック基板上に設けられた電極114とワイヤー115やその他配線パターン等により電気的に接続される。本発明による発光装置に実装されるLEDはLED素子の形態や種類に拘わらず適用可能である。従って、RGB LEDはもちろん白色光LEDのみならず多様な色相のLED素子にも適用し得ることは言うまでもない。LED素子はセラミック基板の周囲に沿ってセラミック基板上に設けられた上部セラミックシート117により囲まれ絶縁層116で密封される。前記絶縁層116はエポキシまたはSi系透明性樹脂等から成ることが好ましい。

【0036】図5は本発明による発光装置の異なる実施の形態を示す。図5の各種発光装置において各符合は理解し易いよう図4に対応している。先ず、図5(a)はLED素子123、123'が実装された前記補助セラミックシート122、122'に他放熱穴122a、122a'が設けられた発光装置を示す。こうした発光装置は図2(a)の多くのLEDを組合せた如き構造を有する。図5(a)による発光装置において放熱穴122a、122a'はLED素子123、123'より小さいことは言うまでもない。更に、セラミック基板121の放熱穴121a、121a'よりは小さく形成することが好ましい。図5(a)による発光装置はLED素子123、123'が直接空気と接触する為、図4に示した発光装置に比して放熱特性が優れることが予測される。

【0037】図5(b)には本発明の更に異なる実施の形態の発光装置を例示する。図5(b)に示す発光装置は図4に例示された発光装置とは異なって、補助セラミックシート132がセラミック基板131全体に互って積層される構造を有する。更に、電極134もセラミック基板ではなく補助セラミックシート132に位置する。こうした発光装置は図2(b)に例示した多数のLEDを組合せた構造を有し、以後の製造過程に示す如く大きな利点を有する。

【0038】更に、図6(a)に例示する発光装置は図5(b)の発光装置の構造において補助セラミックシート142に1個の放熱穴142a、142a'を更に設けている。こうした発光装置は図2(c)に例示した多数のLEDを組合せた構造を有する。

【0039】図6(b)に示した発光装置は図2(b)に例示した多数のLED素子を組合せた構造に適する場合を示している。即ち、こうした発光装置は図2(d)に例示した多数のLED素子を組合せた構造を有するものとして、基板自体の電気伝導度により電界印加方式がLED素子の上・下部により行われる。前記発光装置は補助セラミックシート152、152'上に実装されたLED素子153、153'の下部に位置する他電極1

54a、154'がワイヤー155、155'等により電極154、154'と電氣的に接続される。この場合にセラミック基板151に放熱穴151aを設けているが、補助セラミックシート上にも更に放熱穴を設けることができる。

【0040】以上説明した発光装置は多様な放熱設計により効果的にLEDの熱的ストレスを抑えることができるが、各々の発光装置は放熱穴に導電性材料を塗布したり充填する方法でより効果的に放熱特性を増進することができる。図7には図4の発光装置に適用された方式を例示している。その方式として図7(a)は放熱穴111aの内側に補助セラミックシート112とセラミック基板111との接触面に沿って金属ペースト118aが塗布された発光装置を示す。更に、図7(b)は前記放熱穴111aの内側に金属ペースト118bが充填された発光装置を例示している。更に、図7(c)は放熱穴111aの内側に金属ペーストが充填された図7

(b)の発光装置においてLEDの下部にセラミック基板111に沿って金属板119が付着された発光装置である。図8(a)は放熱穴111aの内側に金属塊(ump or slug)118dが挿入され金属ペーストで接着された発光装置を示す。図8(b)に例示する発光装置は放熱穴111aの内側に金属ペーストが充填された上にセラミック基板111の下部に沿って全て金属ペースト118eが塗布された構造である。これらの発光装置は全て放熱穴111aにより熱放出をより容易に行い放熱穴だけ設けられた場合に比して放熱特性が優れている。こうした構造はもちろん図4に例示した発光装置のみならず多様に放熱設計された図5、6の発光装置にも同一に適用し得ることは言うまでもない。

【0041】こうした多様な放熱構造を有する発光装置の製造工程は基本的に単品のLED製造工程と類似するのがより多様である。図4に例示された発光装置における本発明の製造方法を図9に基づいて説明すれば次のとおりである。図9(a)と図9(b)に示す如く、先ずパンチング工程により多数個の放熱穴111a、111a'を設けたセラミックシートを備える。該セラミックシート上には図9(c)の如くスクリーン印刷方式等により一定形態のパターン電極114を設ける。前記パターン電極114は設計により多様に変更し得ることは言うまでもない。本発明においてはパターン電極としてAg含有ペーストが適する。セラミック基板は1個または2個以上のセラミックシートを積層して構成することができる。更に、セラミック基板には必要によって他の配線パターンを設けることができる。前記セラミック基板を備えた後には、図9(d)の如く前記放熱穴を覆うことのできる一定形態の補助セラミックシート112、112'を積層する。前記補助セラミックシートは前記セラミック基板上に各々1個の放熱穴を覆うよう設けることができるが、少なくとも1個以上の放熱穴を覆うよう

独立した補助セラミックシートから構成することもできる。図10はそうした一例を示している。図10(a)ないし図10(c)に示す放熱装置の製造工程においては、セラミック基板161の一連の放熱穴161a、161b、161cを共に覆うことのできる独立した補助セラミックシート162をセラミック基板161上に積層した後、上部セラミックシート167を積層する過程を示す。更に、前記補助セラミックシートは各々LED素子の下部に1個の放熱穴を更に設けるよう構成することもできる(図5(a)参照)。

【0042】次いで、図9(e)の如く、前記パターン電極の一部と補助セラミックシートの一部または全部が露出するよう所定形状の開口部を設けた上部セラミックシート117を備え、前記セラミック基板上に積層する。その後、前記セラミック基板は同時焼成を行う。この際、同時焼成は約800~1050℃で行うことが好ましい。続いて、図9(f)の如く、前記セラミック基板のパターン電極上にめっきにより電極を設ける。本発明において電極はセラミック基板上のAgペースト層にNi及びAuを順次にめっきすることが好ましい。前記電極を設けた後には補助セラミックシート112、112'上に備えたLED素子113、113'を実装する。その後、前記電極114とLED素子とをワイヤーにより電氣的に接続させてから、前記上部セラミックシート117内のLED素子113、113'を絶縁樹脂で密封する。

【0043】図11は本発明による発光装置の更に異なる製造工程を示す。こうした製造工程を経て得られる発光装置は図6(a)の如き構造を有するであろう。図11に示した製造工程は図9の製造工程とは異なって、1個の補助セラミックシート152を用いてもよいという利点があり実際に製造工程が大幅に単純化され得る。図11に提案した発光装置の製造方法は放熱穴151a、151a'を設けたセラミック基板151上にパターン電極が設けられず、補助セラミックシート152上に設けられる。即ち、パンチング過程により前記放熱穴151a、151a'より小さく且つLED素子より小さい他放熱穴152a、152a'を設けた補助セラミックシートを備え、前記セラミック基板上に放熱穴の中心線が一致するよう積層した後(図11(c))、補助セラミックシート上に一定形態のパターン電極154を設ける(図11(d))。以後の製造工程は図9と同一である。

【0044】本発明による発光装置の製造工程はこれに限らず前記セラミック基板の放熱穴とは別途の放熱開口部(openings for heat sink)を設けることもできる。図12はそうした例を示す。図12にはセラミック基板171を製造する際に放熱穴171a、171a'とは別途に前記放熱穴の周囲に放熱開口部の如き別途の放熱手段をパンチングにより打ち抜いた過程を示す。こうした構造を有する発光装置はLED素子から発生した熱をよ

り広い面積に至って空中に放熱できる為、多数の発光装置を用い高密度で発光ユニットアセンブリーを組合せることができ、更に発光ユニットアセンブリーの発光面をより大面積に構成できるという利点を有する。

【0045】本発明の製造方法において上部セラミックシート177は多様な形態から成ることができる。上部セラミックシートはユーザーまたは使用条件等の外部環境に合わせて多様な形状に設計することができる。図13は上部セラミックシートの多様な形状を例示している。図13に示す前記上部セラミックシートの開口部または窓(windows)にはLED数を適切に配置して発光面の面積と形態を効率的に決定し得る。

【0046】(発光ユニットアセンブリー) 本発明においてはこれまで説明した発光装置を少なくとも1個以上配置して大面積の発光ユニットアセンブリーを構成することができる。図14はそうした発光ユニットのアセンブリーの一例として、理解が容易なように図面において上部セラミックシートは略した。本発明による発光ユニットアセンブリーは発光ユニット210を適切に配置して成る。更に、発光ユニットアセンブリーでは上部に積層される上部セラミックシートをバンチングにより形状と形態を適切に形成し発光面積及び発光面の形状を調節できるので、LED素子から照射される光の量も調節し得る。特に、本発明の発光ユニットアセンブリーは多様な放熱設計ができLED素子から発生する熱の放出が容易なので、LED素子を高密度大面積に設計することができる。

【0047】

【発明の効果】 上述の如く、本発明によるLEDは多様な放熱設計によりLED素子から発生する熱の放出を効率的に行いLED素子の熱的ストレスを最小化にできてLED素子の安定的な動作を行える。更に、本発明は高密度でLED素子を大面積基板上に実装し得る発光装置を提供する。こうした発光装置は多様な色相(full color)を呈するディスプレイ等の発光源のみならず白熱電球や蛍光灯、街灯を代替し得る次世代照明設備に大変適する。

【図面の簡単な説明】

【図1】 本発明による発光ダイオードの構成図である。

【図2】 本発明による異なる発光ダイオードの断面図である。

【図3】 本発明による更に異なる発光ダイオードの断面図である。

【図4】 本発明による発光装置の構成図である。

【図5】 本発明による異なる発光装置の断面図である。

【図6】 本発明による異なる発光装置の断面図である。

【図7】 本発明による更に異なる発光装置の断面図である。

【図8】 本発明による更に異なる発光装置の断面図である。

【図9】 本発明による発光装置の製造工程図を例示するものである。

【図10】 本発明による発光装置の異なる製造工程の一部である。

【図11】 本発明による発光装置の更に異なる製造工程図を例示するものである。

【図12】 本発明による発光装置の更に異なる製造工程の一部である。

【図13】 本発明による発光装置の上部セラミックシートの例示図である。

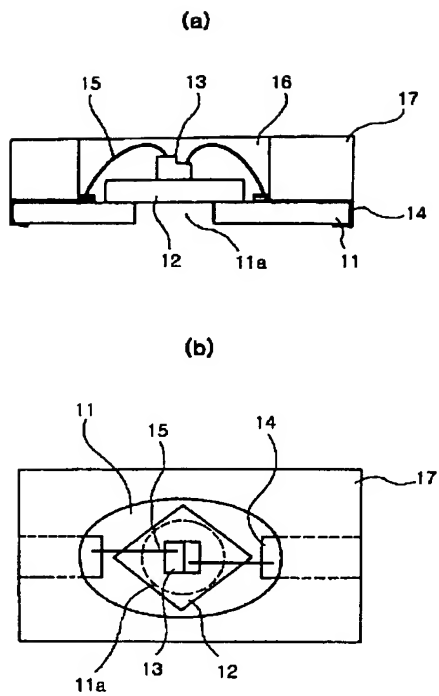
【図14】 本発明による発光素子を用いた大面積発光装置の構成図である。

【図15】 (a)は従来の発光素子の断面図であり、(b)は(a)の発光素子を用いた発光装置の断面図である。

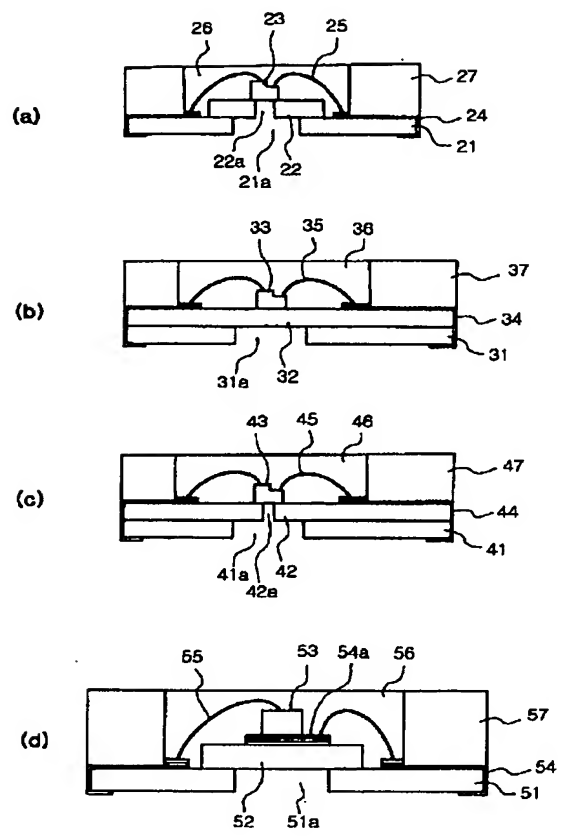
【符号の説明】

111、121、131、141、151、161、171 セラミック基板  
111a、121a、131a、141a、151a、161a、171a 放熱穴  
112、122、132、142、152、162、172 補助セラミックシート  
113、123、133、143、153、163、173 発光ダイオード  
114、124、134、144、154、164、174 電極  
115、125、135、145、155、165、175 ワイヤ  
116、126、136、146、156、166、176 絶縁層  
117、127、137、147、157、167、177 上部セラミックシート

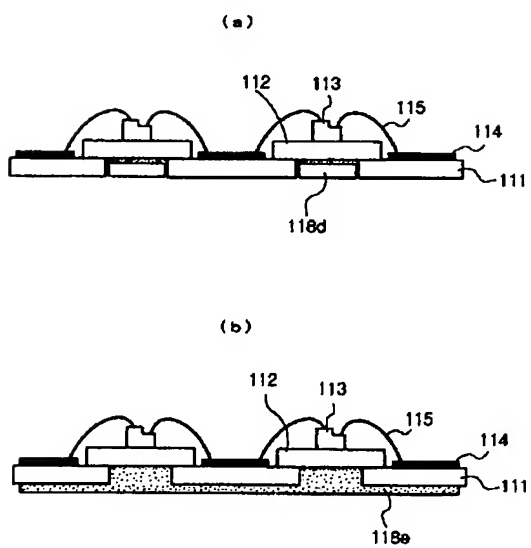
【図1】



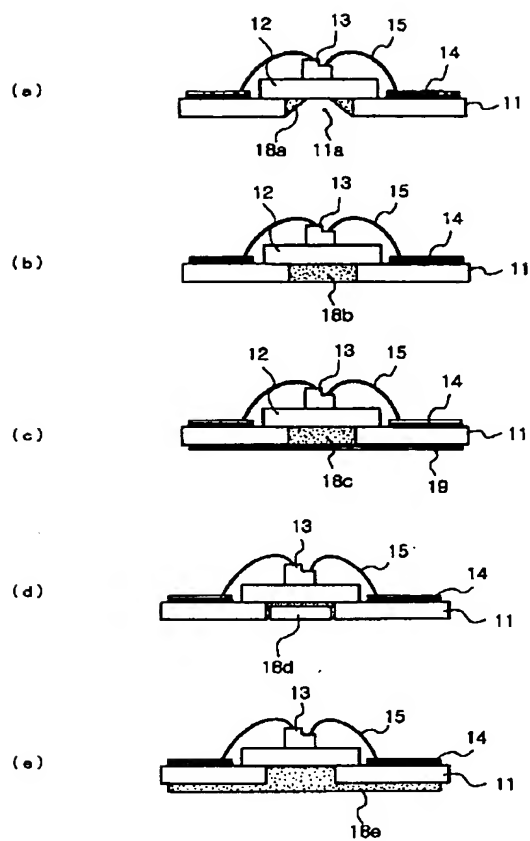
【図2】



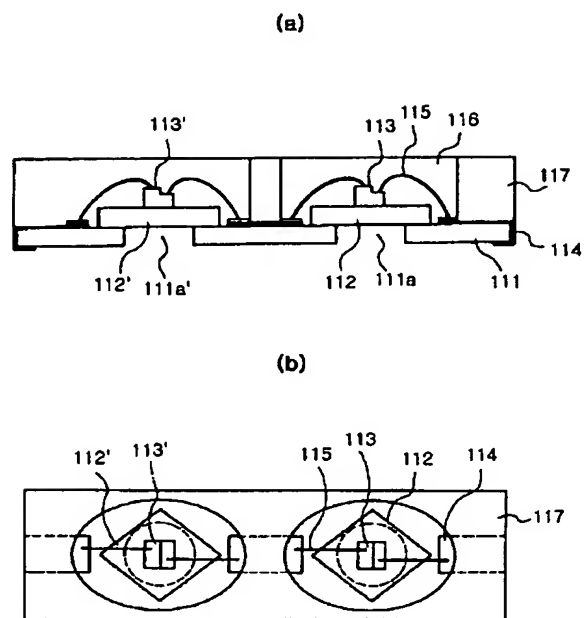
【図8】



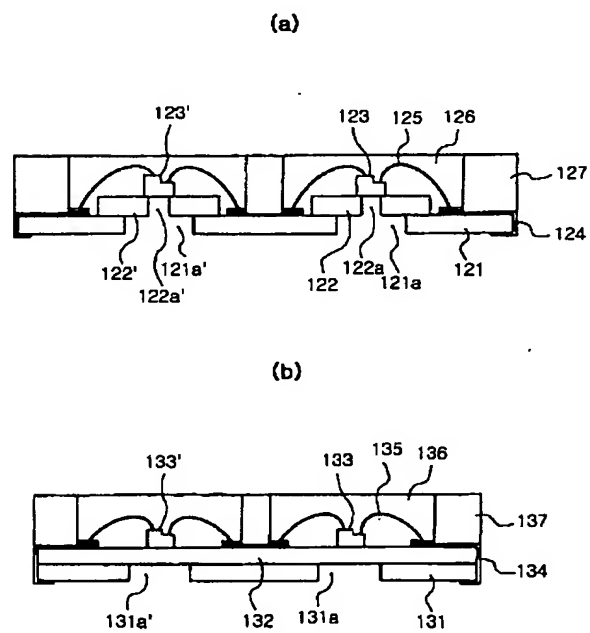
【図3】



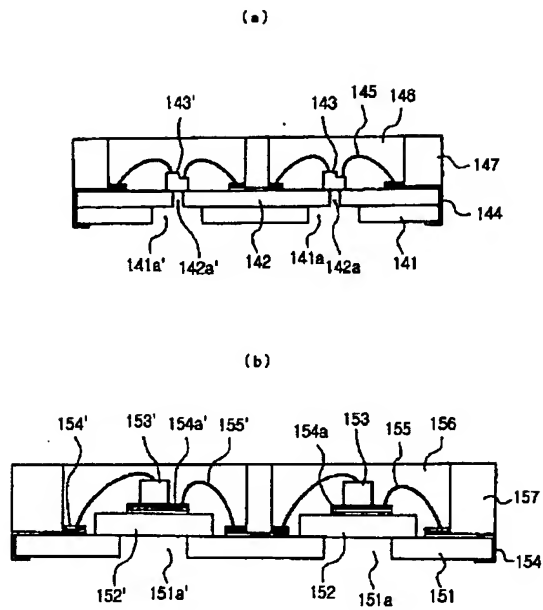
【図4】



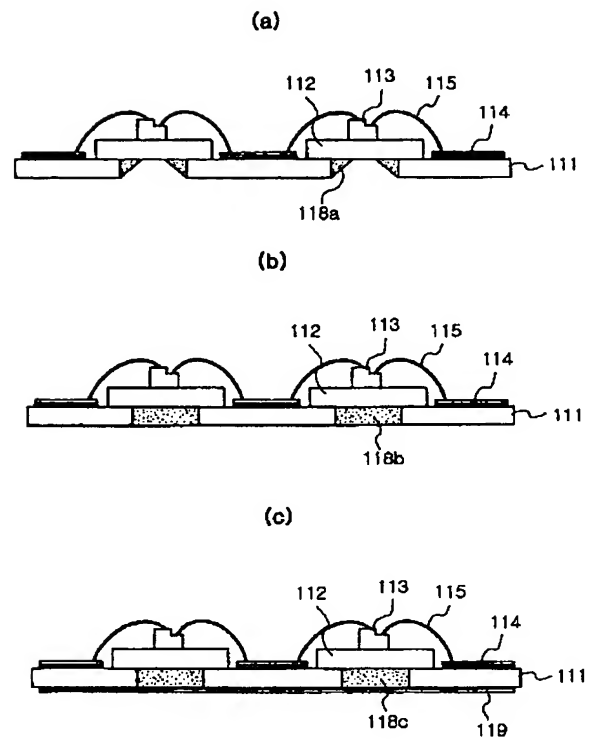
【図5】



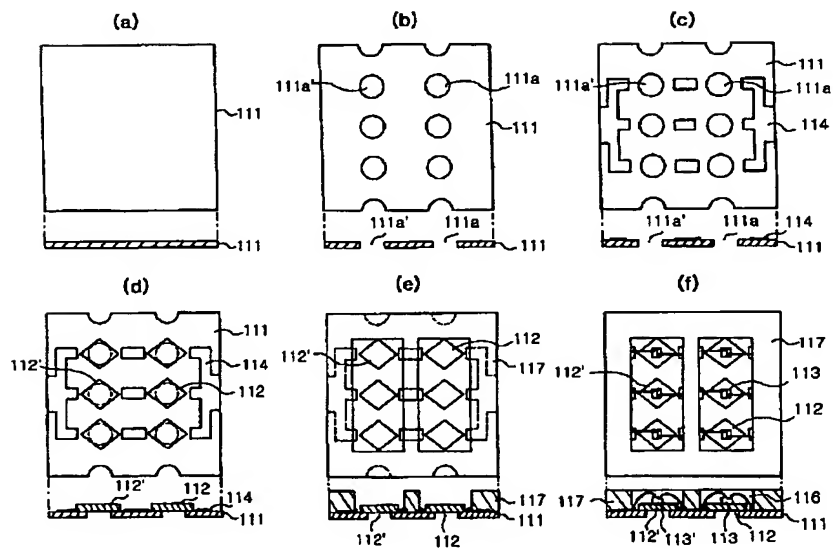
【図6】



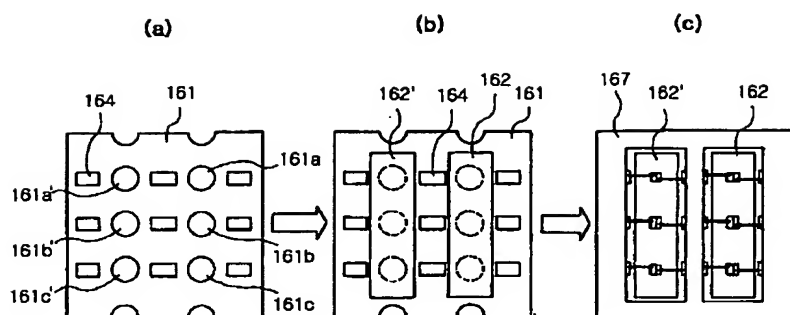
【図7】



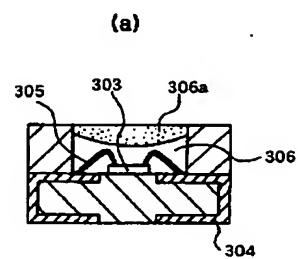
【図9】



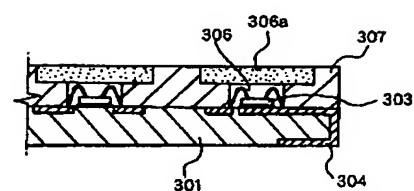
【図10】



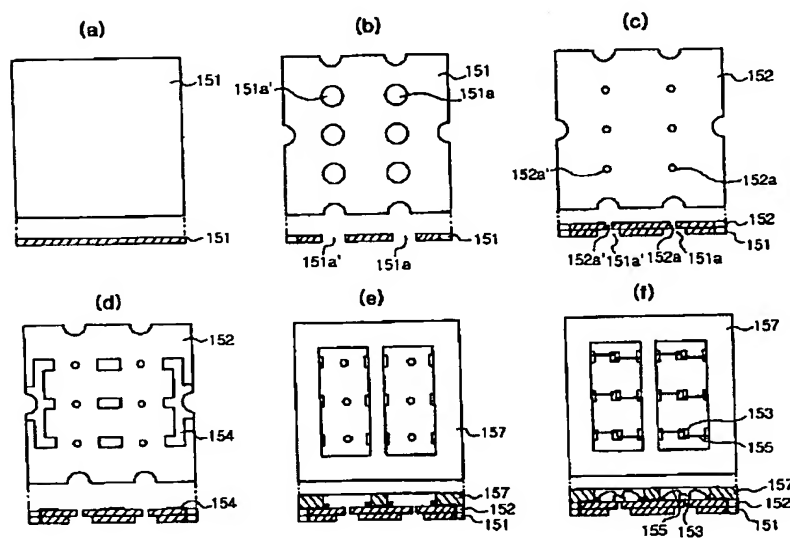
【図15】



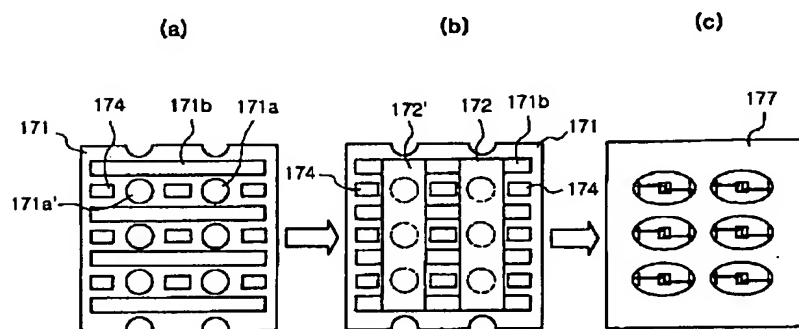
(b)



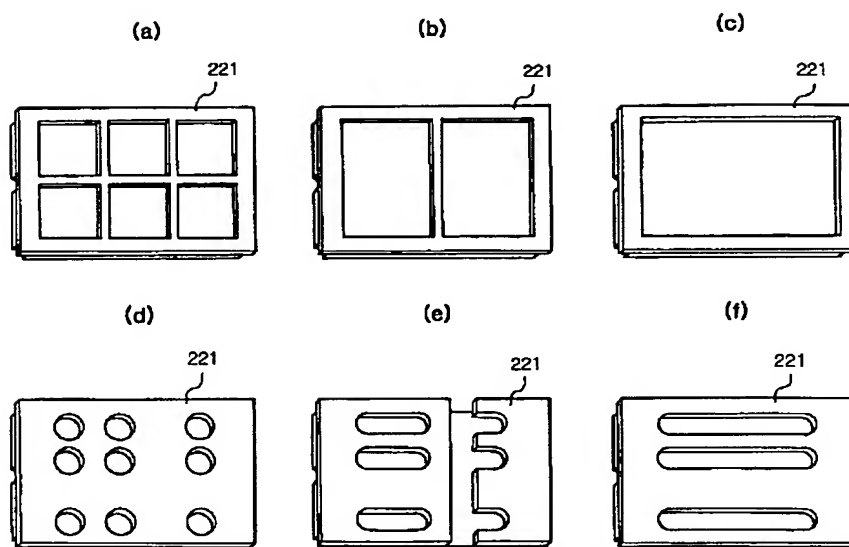
【図11】



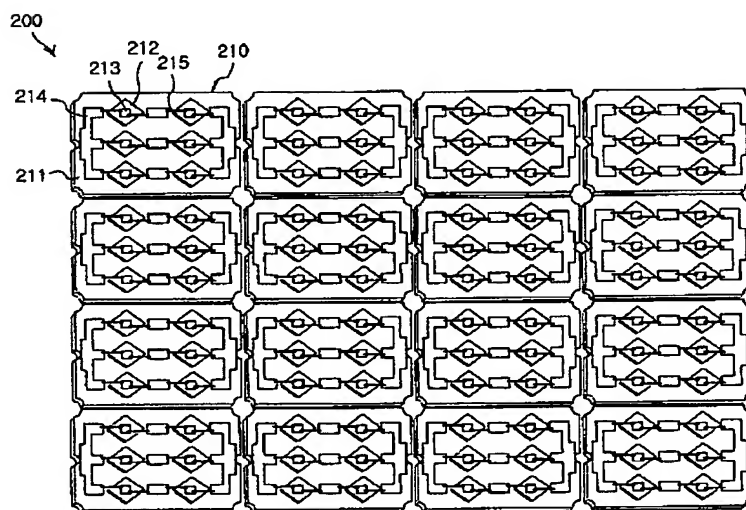
【図12】



【図13】



【図14】



フロントページの続き

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